

March 23, 1959

# Aviation Week

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In Army Missilry

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When the "go/no-go" signal depends upon a complexity of parts and pieces supplied by scores of subcontractors, the system engineer must work with a prime contractor responsible. It must be his preference that the multitude of components will stand up to the principles of his design. In the design of modern high-performance aircraft and missiles, often the heart of the propulsion system (or of a major auxiliary system) is a pressure vessel.

Whether specifications call for titanium, or stainless steel spheres, or more specialized configurations, even exotic materials and alloys, it is the ultimate reliability of the hardware that will prove or disprove the system design. That is why coating engineers spe-

cify pressure vessels by Rheem. That is why over the past seven years companies like Convair, North American Aviation, and Lockheed Aircraft Corporation have ordered more than 25,000 Rheem pressure vessels for applications in the major aircraft and space projects of the nation.

When an experienced hand in critical welding and machining operations is needed for the production of vessels that can be relied upon, consult the leader in pressure vessels. Consult Rheem early. Let Rheem engineers assist you in the development, as well as in the production, of vessels and containers to meet your specialized needs. Write to Dept. AAW-717-L.

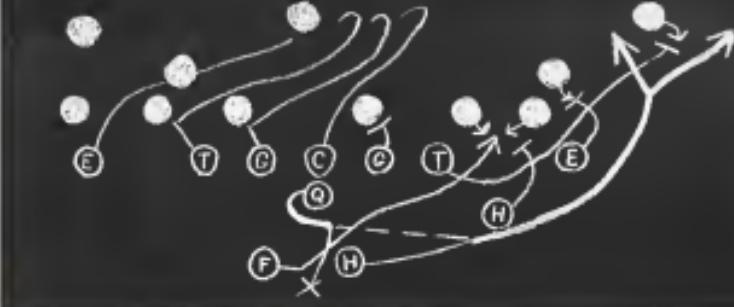
First in Pressure Vessels

**RHEEM MANUFACTURING COMPANY**

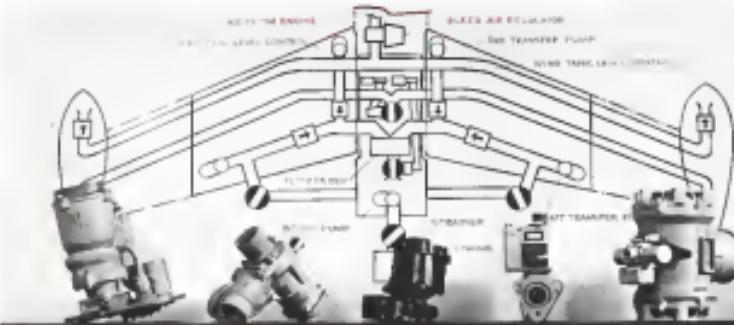
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Team planning...



## For successful fuel control

Booster pumps, transfer pumps, shutoff valves, selector valves, regulators... In the complex fuel-control system of a supersonic aircraft or missile, not only must each component be individually flawless, but all must function perfectly together.

Hydro-Aire not only makes individual components of unequalled accuracy and precision, but offers unrivalled experience in designing and combining system components in smoothly integrated packages.

Whether your problem involves Argus, HEF, or other exotic fuels, when pumps and valves and motors and other components must function as a team, let us call the signals.

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Hydro-Aire, Inc.  
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Anti-Ice Systems • Fuel  
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Producing Controls for Every  
Basic Aerospace System



**AIRBORNE MODULAR DESIGN ACTUATORS  
SPECIFIED FOR ELECTRA CABIN SYSTEMS**

Airborne 51012-2000 modular actuator system and optional remote cover of cabin air pressurizing system.



**DESIGN ENGINEERING DATA**

**Airborne Modular Design ACTUATOR System**

**Table 2**

B: 310 mm, 400-cycle resonance motor with magnetic brake.

C: Speed of actuator load at 400 Hz, 200 mm/sec. (max) 1900 N-m, 1.0 m/sec. (max) 1000 N-m.

D: Acceleration 1.0 m/sec.<sup>2</sup>, 400 Hz, 1.0 N-m, 1000 N-m.

E: Weight: 4.0 kg.

F: The actuator is designed to 2.0 m/sec. (max) 1900 N-m, 1.0 m/sec. (max) 1000 N-m, 1.0 N-m, 1.0 m/sec.<sup>2</sup>, 400 Hz.

**Airborne Modular Design ACTUATOR System**

**Table 3**

B: 200 mm, 400-cycle resonance motor with magnetic brake and magnetic load, 1000 N-m, 1.0 m/sec. (max) 1000 N-m.

C: Speed of actuator load at 400 Hz, 200 mm/sec. (max) 1900 N-m, 1.0 m/sec. (max) 1000 N-m.

D: Acceleration 1.0 m/sec.<sup>2</sup>, 400 Hz, 1.0 N-m, 1000 N-m.

E: Design incorporates 2 limit positions, 2 intermediate positions, 2 positions incorporating positive stops, magnetic limit stops.

With Airborne modular actuators, you are no longer limited to a few standard models whose design is relatively fixed. Instead, you can specify any one of several hundred possible combinations of interchangeable parts to get exactly the capacity and configuration you want. This gives you greater design freedom without the cost and delay of redesign.

While redesigning under the modular concept, we have also reduced the size and increased the performance of many Airborne actuator components. You get more power in a smaller package, save valuable weight and space.

For full information on Airborne modular design electromechanical actuators, request Bulletin STA (Series 500) or Bulletin 100-58 (series).

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BILLERICA 1, MASSACHUSETTS

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**AVIATION CALENDAR**

(Continued from page 5)

Apr. 21-23-Spring Technical Conference on Electronic Data Processing, Cincinnati Section of the Institute of Radio Engineers, Engineering Society of Mfg., Cincinnati, Ohio.

Apr. 21-23-North Annual Convention, International Aviation Navigation Council, Hotel Manhattan, New York, N.Y.

Apr. 22-24-1978 Annual Meeting, Institute of Environmental Engineers, Littlefield Hotel, Atlanta, Ga.

Apr. 25-26-Annual Eastern Regional Meeting, Institute of Navigation, Friendship International Airport, Baltimore, Md.

Apr. 25-26-Quarterly Regional Meeting, Assoc. of Local and Technical Agents, Hotel New Yorker, New York, N.Y.

Apr. 29-May 1-First National Metal Drying Meeting Conference, American Society of Mechanical Engineers, Hotel Statler, 1000 Peachtree, Atlanta, Ga.

Apr. 18-May 1-Communicate Satellites Conference, American Rocket Society, Mass. Institute of Technology, Cambridge, Mass.

Mar. 15-16-Symposium on Electronic Power, Hotel Pa, Spokane, Wash. American Association of Chemistry and Electromechanical Society (Cincinnati Electromechanical Society), 1800 Broadway, New York 10019, N.Y.

May 16-18-National Aerospace Electronics Conference, Institute of Radio Engineers, Silverside Hotel, Dayton, Ohio.

May 4-5-Fifth Annual Flight Test Instrument Symposium, sponsored by the Institute of the Aerospace Sciences, Flying Hotel, Seattle, Wash.

May 17-Annual Meeting, California Assoc. of Airport Engineers, Casa Mierlos, San Jose, Calif., Monterey, Calif.

May 18-19-1978 Electronic Components Conference, Englewood Cliffs, N.J.

May 18-19-1978 Annual National Press American Meteorology Society, Sheraton Park Hotel, Washington, D.C.

May 18-19-1978 Annual National Conference, Society of Aerospace Engineers, Hotel Penn, Philadelphia, Pa.

May 26-28-National Space Working & Evaluation Society for Experimentally Stress Analysis, Sherrill Park Hotel, Washington, D.C.

May 28-June 1-1st Apr. Aircraft Conference, American Society of Civil Engineers, Sheraton Dallas Hotel, Dallas, Tex.

May 21-22-1978 Ohio Valley Instrument and Aerospace Exhibit and Symposium, Cincinnati Section, Instrument Society of America, Music Hall, Cincinnati, Ohio.

May 24-June 1-1978 Annual Aerospace Instrumentation Meeting, Phoenix, Ariz.

May 24-27-1978 National Telecommunications Conference on Investigation of Space, Beacon Palace and Congressmen's Hotel, Detroit, Mich. Institute of American Rocket Engineers.

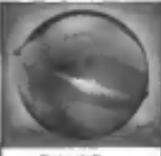
May 24-27-1978 Annual Aerospace Instrumentation Meeting, Phoenix, Ariz.

May 26-28-Symposium on Transport, San Diego Section, Institute of the Aerospace Sciences, San Diego, Calif.

March 16-18-1978 THE DIVISIONS OF THOMPSON RAMO WOOLDRIDGE INC.



Dual propellant auxiliary power unit



Surface missile pump unit



Orbital missile anti-satellite test pump



Orbital switch



Point-blank target aircraft

**100 MILLION JET ENGINE BLADES  
1.1 MILLION AIRCRAFT AND MISSILE FUEL PUMPS  
APU'S FOR 6 DIFFERENT MISSILES**



**TAPCO GROUP**

These are some of the products of the TAPCO Group of Thompson Ramo Wooldridge Inc. With \$100,000,000 of high-efficiency production facilities, TAPCO is one of the nation's leaders in the development and manufacture of mechanical systems, equipment, and components that meet most stringent performance specifications under extreme conditions of temperature, corrosion, and stress.

Through its metallurgical and chemical laboratories, TAPCO continually extends its capability in the technology of high-temperature alloys, powder metallurgy, ceramics, composites, and other materials. TAPCO was one of the principal powers in the fabrication of titanium, and is con-

tinuously engaged, in cooperation with E. I. du Pont de Nemours & Co., in the development of manufacturing techniques to hold sulfide and in alloy.

In product design and development, TAPCO's 800-man engineering team is experienced in a wide range of specialties, including hydraulics, aerodynamics, electronics, pneumatics, thermodynamics, and mechanics.

Aerospace and missile technology increasingly demands mechanical systems, equipment, and components that can meet extreme requirements of position, strength, and reliability under the most severe environmental conditions. The combination of engineering, metallurgical and manufacturing capabilities represented in the \$100,000,000 per year revenues of the TAPCO Group provides an integrated capability of unusual effectiveness for the design and manufacture of such products.



100-1000 rpm variable airframe controller



Mobile cart mounted unit



Infrared heat shield

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STRAIGHT TALK FROM

# TEMCO | AIRCRAFT DALLAS

**QUESTION:** What is Temco's experience in the fields of electronics, aircraft and missiles contracts?

**ANSWER:** During the past 14 years, Temco has successfully completed 35 major programs requiring solutions to engineering design problems in all technical fields involved in the aerospace sciences. It has produced more than 5,000 components of high performance military weapons systems.

**QUESTION:** What is the scope of management's knowledge and participation?

**ANSWER:** Programming under top management is initiated at the earliest project stage and maintained throughout the existence of the job. Overall progress is reviewed at periodic check points to permit timely corrective action if necessary, and to keep management and the customer informed on the program status.

**QUESTION:** What are Temco's plant facilities?

**ANSWER:** Temco has three major plants, comprising over 2,000,000 square feet, fully equipped for the development and manufacture of complete aircraft, missiles and major subsystems. Included is a new Engineering Center with ultra-modern laboratories and experimental design area. Construction is scheduled early this year on vastly increased production facilities.

**QUESTION:** What are Temco's engineering capabilities?

**ANSWER:** Temco has over 1,200 engineers whose combination of skills and unique capabilities has established Temco as a leader in advanced technology.

**QUESTION:** What is the range of Temco's product familiarity and production know-how?

**ANSWER:** Temco is prime contractor and weapons system manager for the Navy's Convair air-to-surface stand-off missile; it has designed, developed and produced the T-11 "Pinto" jet trainer and the X-20D-1 "Taifun" rocket-powered target drone. In the composite field Temco products range from integrated antenna systems to high production major assemblies for such advanced aircraft and missiles as the F-2H, F-101, F-104, B-57G, Hawk, jet engine and work on classified ballistic missiles. In the modification and overheat field, activities have spread all the way from F-4's overheat of C/R's to development and modification of advanced electronics systems.

**QUESTION:** What plus does Temco offer?

**ANSWER:** Temco is known by its customers as a "Yellow-throated" company, from design to production - a partner on the job - a company that delivers quality products on schedule at the lowest possible cost.

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STRUCTURAL RESEARCH

DEVELOPMENT

PRODUCTION



ELECTRONICS • AIRCRAFT • MISSILES



SPACE SAVING DESIGN

## LOCK HOLDS 27,750 LBS. WITH GEAR COMPRESSED 96% OF STROKE

Temco's unique designed the R-77 landing gear with a unique "tandem lock" that adds the dual strut compressed under 2.6 times the normal compressed pressure. When gear is dropped, lock automatically releases and strut is fully extended. Steel parts are heat treated 265,800-285,800 psi tensile strength.

More than 50,000 landing gear units have been produced by WALTERS DEDICATED, as well as other proven aircraft components, avionics, accessories, navigation systems and ground support and ground handling equipment. Engineering, tool, equipment and customer production facilities are available to you.

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**OSI** **Western Design**

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Santa Barbara and Montebello, California  
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324-1138

You can actually lead a Fenwal Continuous Fire Detector System to your needs as easily as a snake charmer handles his cobra! It's as simple as a snake.

Proven applications of this advanced multi-point protection system are practically everywhere in aircraft and missiles — for hot gas lines, oxidizing systems and, of course, for engine protection. That's versatility!

Extremely lengths of tubing, such as a different temperature, can operate independently in one normal loop in a wheel well, near a bleed air duct, in a "cold pack" engine compartment, in an engine nacelle, or wherever temperature hazards exist. Rugged "static" sensor and magnetic amplifier provide discrete non-averaging sensing of temperature. And this positive protection is repeatable!

You'll think of many applications for Fenwal Continuous Fire and Overheat Detector Systems. Talk them over with a Fenwal Sales Engineer. Get our latest Catalog, too. Write Fenwal Incorporated, 135 Pleasant Street, Ashland, Massachusetts.

## You Call the Tune...

the Fenwal Continuous

Fire and Overheat Detector has hundreds of applications

The single, bullet-like sensing probe of the Fenwal Continuous Fire Detector slips easily into the tightest spots of a plane or missile. It stays like a clothespin. Then it is a light, no-moving-parts control unit.



ANOTHER  
EXAMPLE  
OF HOW

**Fenwal**

CONTROLS TEMPERATURE . . . PRECISELY



**BURST PRESSURE**  
**24,000 psi.!**  
**OPERATING PRESSURE: 6000 psi.**

### Aeroquip ANNOUNCES VERY HIGH PRESSURE A/T PTFE/HYDROGEN HOSE LINES OR TEFLOC

Aeroquip makes an major contribution to safety in the handling of very high pressures and, indeed, in many other areas for mobile chemical systems. Newly developed and now available is rugged A/T PTFE Hose and TEFLOC, rated for 4000 psi. pressure . . . with a 4-to-1 safety factor!

With an inner tube of TEFLOC, which has zero permeation absorption and an anti-reflection surface, Aeroquip A/T Hose allows fast, easy purging and dehydrating. The tube has supreme resistance to vibration, low volumetric expansion and high-temperature resistance. Refer to catalog for complete information.

**Aeroquip**

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 AEROQUIP CORPORATION, WESTERN DIVISION, BURBANK, CALIFORNIA  
 AEROQUIP (CANADA) LTD., TORONTO, ONTARIO, CANADA  
 AEROQUIP PRODUCTS AND PARTS DISTRIBUTED BY FEDERAL CARBON, KANSAS CITY, MISSOURI  
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Aeroquip G/T PTFE/Hydrogen Hose or Teflon . . .	
Heavy duty hose line	6270-6
Hose size 1/2"	312
Hose size 3/4"	437
Hose size 1 1/2"	609
Outer protect. coil	6-000
Protect. gasket	24-000
Weight (each of pressure)	5
	16

All dimensions in inches

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### Heating Blankets and other Woven Heating Elements by **SAFEWAY** can make your **COLD** problems **OLD** problems!

To keep sensitive equipment, fuels, propellants and lubricants at correct operational temperatures in any cold environment, controlled heat must be delivered with utmost dependability. **SAFEWAY** delivers it — everywhere.

Among the wide variety of heating blankets and woven-wire heating elements successfully engineered by **SAFEWAY** to meet tailor-made specifications are:

- **heating blankets for honeycombs and metal-to-metal bonding**
  - deicing units for airfoil surfaces
  - **heating elements for launching equipment and for ride-on gyres, cameras, computers, servos and batteries — for missiles or aircraft**
  - **radiant heating panels for industry**
  - **defrosting coils for industrial and commercial refrigeration**

FOR YOUR COPY OF A FACT-FILLED FOLDER, PLEASE WRITE.

**Safeway** HEAT  
ELEMENTS  
INC.  
680 Newfield Street • Middletown, Connecticut

If it has to be heated (and the "it" can be just about anything), you can rely on **SAFEWAY** engineers to study your problem and — without any obligation — submit an appropriate recommendation.



...NEWS IS HAPPENING AT NORTHROP

## RADIOPLANE RP-77D SETS NEW DRONE ALTITUDE MARK!

New holder of an unofficial world altitude record for propeller-driven drone aircraft — Radioplane's RP-77D serial target. This record-breaking bird climbed to more than 46,000 feet during Army evaluations at Dose Ana Range, Fort Bliss, Texas.

Sideways on the flight, the record-setting drone had six previous flights to its credit — is ready for further action after its seventh recovery by two-stage parachute.

Rocket launched, Radioplane's RP-77D is turboprop powered to spool in excess of 400 miles per hour at above 40,000 feet — and is capable of flight duration exceeding one hour at this altitude. Relative to performance, it is a low-cost target. Constructed almost entirely of fiberglass laminate, the RP-77D has an additional capability for photo and television camera surveillance missions.

Other current Radioplane drones in development are the supersonic USAF XQ-4A weapon evaluation target and the XKDR-1 rocket target for the U.S. Navy — two more members of the world's only complete drone family.



**RADIOPLANE**  
Val Mesa, California, and El Paso, Texas  
A Division of Northrop Corporation

This is the sixteenth of a series of advertisements dealing with basic facts about alloy steels. Through much of the information presented, we believe it will be of interest to many in the field, including men of broad experience who may find it useful to review fundamentals from time to time.

## Uses of Aluminum in Alloy Steels

Aluminum as an element has been known to chemists and metallurgists for many years. It is never found in nature in its metallic state, being derived chiefly from bauxite, an aluminum hydroxide. Bauxite is present in various parts of the world, including several tropical and semi-tropical regions.

When used in the making of alloy steels, aluminum has several important functions. Because of its great affinity for oxygen, it is a reliable deoxidizer. It produces fine austenitic grain size. And when it is present in amounts of approximately 1 pct, it promotes nitriding. The nitriding process could be described as surface- or case-hardening by means of a nitrogenous medium, or by heating in an atmosphere of ammonia gas and dissociated ammonia mixed in proper proportions.

Other effective agents in producing nitrided cases are chromium, vanadium, tungsten, and molybdenum. As a rule, however, the hardest cases are obtained with aluminum-bearing steels, the nitriding grades being a good example. These are

usually steels of medium carbon content with additions of chromium, molybdenum, and sometimes nickel.

Generally speaking, the lower the effective nitriding temperature, the harder the case will be. Aluminum-bearing steels usually show a case-hardness range of 950 to 1150 DPHN (diamond pyramid hardness number). Steels in which no aluminum is present have cases of substantially lower hardness.

If you would care to know more about aluminum as an addition or alloying agent in steels, Bethlehem metallurgists will gladly give you full information. Just write or call; our technicians are always at your service. They will do everything possible to help make your problems easier. And whenever you need new supplies of alloy steels, remember that Bethlehem manufactures the full range of AISI standard alloy grades, as well as special-analysis steels and all carbon grades.

**BETHLEHEM STEEL COMPANY**  
BETHLEHEM, PA.

On the back cover of this booklet are some brief facts about the uses of aluminum in aircraft and aerospace.

Bethlehem Steel Aircraft Committee

**BETHLEHEM STEEL**



## THE HILLER 12E opens new horizons in helicopter performance

Maximum Speed at Sea Level - 105 MPH  
Range at Best Cruise - 115 Miles  
Maximum Rate of Descent - 1500 FPM  
Maximum Ceiling - 14,500 Feet  
Gross Weight - 2700 lbs.

### Equipped with Macwhyte Control Cables

An engineering framework in verified flight, Hiller's 12E provides more ton miles per hour for industrial and commercial uses. Its beauty, licensing 305 hp engine, provides greater payload capacity. Longer range, greater ceiling, greater rate of descent at both altitude and ground, and remarkable endurance under tough going. With plenty of room for three passengers, the 12E is built on the same dependable air frame as the Army's rugged H-22D Hiller Huey. The 12E leads the class in flight and landing load safety factors.

Every moving part, every component on the 12E was carefully selected to ensure outstanding performance and dependability. That's why Hiller chose Macwhyte control cable for the 12E's main rotor and tail rotor systems.

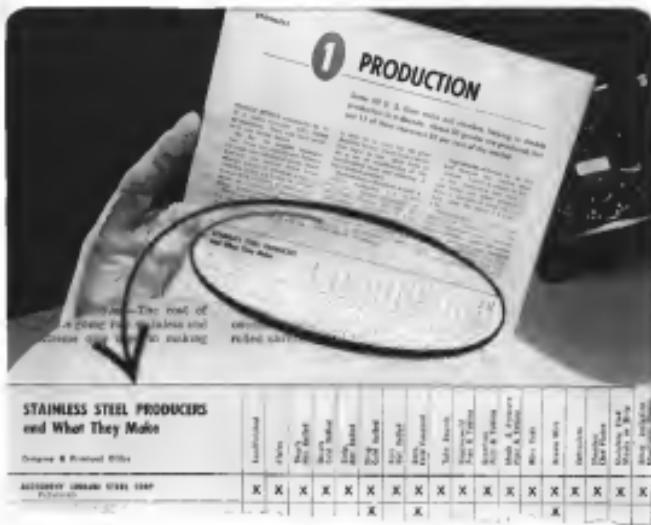
Macwhyte "Hi-Snapline" Aircraft Cable is made in a complete line of sizes and types. Macwhyte "Safe-lock" Cable terminals of stainless steel are available loose or in complete assemblies ready for installation. Macwhyte Aircraft Cables, Terminals, and Assemblies meet the requirements of aircraft manufacturers, airframe, and military specifications. Aircraft Catalog A-3 on request.



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2100 Pennsylvania Avenue, Bethlehem, Pennsylvania  
Orville • Terrellville • Aspinwall • The Woods

**MACWHYTE WIRE ROPE**

Distributed and stocked throughout the United States



**Of the 60 producers of stainless steel...**

only ALLEGHENY LUDLUM makes all sizes, shapes, finishes and analyses

In its November 4, 1957 issue, **STEEL** magazine published a complete round-up on the stainless steel industry. This article reveals that only **Allegheny Ludlum**, of the 60 some companies making stainless, produces all sizes, shapes, finishes and analyses.

This can save you considerable time and money. When you make Allegheny Ludlum your one source of steel, you work with one sales engineer—one order, whether you buy sheet, bars, beams, tubing or whatever.

And, at the same time, you get the best technical service, A&L's craft research and development department a continually searching for new alloys, and better ways to use

today's findings are freely available to you through other scientists, technicians and special libraries.

Allegheny Ludlum follows the product from the mill through to finished form, has greater quality control over the steels than you buy. And since A-L makes all forms of steels, you get unbiased recommendations as to what is

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disinfectant of all surfaces. Call now. 813-222-1000.

representative today — see how we can save you money and time. Get write *Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa.*

## ALLEGHENY LUDLUM

第一人称之第一、三人称之第二人称。



B.F.Goodrich

**At B.F. Goodrich  
the space age  
started in 1934**

That was the year B. F. Goodrich developed the first rubber atmosphere flying suit for attempts at setting altitude records. Through the years this suit has been constantly improved to meet the needs of high-altitude pilots. And when the first man sets foot on the moon, he will probably be wearing a modification of today's B. F. Goodrich Full Pressure Suit.

B F Goodrich engineers are working in many ways to help make the roads of our country safer and more pleasant. Improved road surface, paved highway shoulders, flexible heavy bitumens, asphaltic concrete, paved and crushed stone aggregate, metal and plastic pipe, asbestos materials, insulating materials, asbestos rubber seals and gaskets, blood thinners—these are only a few of the innovations that may help solve your transportation problems. For specific B F Goodrich information, write *B. F. Goodrich Company, Product Division of The B. F. Goodrich Company, Case 457, 440-442, Oberlin, Ohio.*

**B.F.Goodrich** *aviation products*



# EDITORIAL

## From Capitol Hill

As Congress heads for its Easter recess, the pattern of debate on key areas affecting the aviation industry and its related technologies is becoming clearer. Bright spot light continues to be focused on the Defense Department budget where the fiscal adequacy of our military programs are being challenged by an increasingly large group of congressional critics. Although the critical edge of the defense debate has been sharpened by such leaders of the Democratic majority as Senators Lyndon Johnson, Richard Russell and Stuart Symington, they have been joined in recent weeks by such Republicans as Senators Levenett, Schuman, Styles Bridges and Jacob Javits.

President Eisenhower has made the strongest personal effort to back his fiscal 1960 defense budget, including nine successive weekly press conferences, a national television appearance and the most unusual device of having each member of the Joint Chiefs of Staff formally sign a document stating that the defense budget was "adequate." The effect of these Joint Chiefs signatures on the document was somewhat diluted by a series of statements filed by each service chief detailing the vital program in his area. But those uttered or signed, certainly is this "adequate" defense budget.

Key issue on which the fiscal 1960 defense budget debate appears to hinge is the gap in ICBM strength between the U.S. and the USSR. That the Administration suddenly and deliberately new plans to permit during the next five years.

No American citizen can feel very secure over a deliberate decision to allow a potential enemy the opportunity to build a strategically important lead over this country in the most technically advanced type of weapon likely to be available during the next five years—the liquid-fueled, intermediately guided ICBM delivering a nuclear warhead.

Defense Secretary Neil McCallum has stated that the Soviet lead in this area would amount to a three-to-one edge by the end of 1961 under present plans. Sen. Symington has rated that ratio as four-to-one on the basis of the same evidence and Sec. McCallum has still phasing figures serially being used in the Postage stamp class to doubling time quoted add that this country will lose its ICBM capability by the end of 1961. In the flux of this evidence, even such conservative Republican papers as the New York Herald Tribune and Life magazine have followed Aviation Week's critical lead and called for a reevaluation of ICBM production and operational programs with a view toward increasing them significantly to meet the Soviet challenge.

USAF has now drafted a program aimed at doubling production of the Atlas ICBM, the only such missile now sufficiently advanced along the development cycle to warrant such consideration. But this program, which now is fully supported by USAF, has yet to clear the Defense Department budget hurdle and has yet to be endorsed by the White House.

With the White House to get an unusually close scrutiny on Capitol Hill during the remainder of the

session, Sen. Mike Monroney, an influential leader in that area, is not satisfied with the course of federal import and policy as pursued by the Administration. He will also keep an eagle eye on the burgeoning operations of the new Federal Aviation Agency. Adequacy of present and proposed airway modernization and safety programs will be a subject of increasing debate. Possible discontinuance of the FAA by a relatively small but less group of military efficient is also a worry on Capitol Hill.

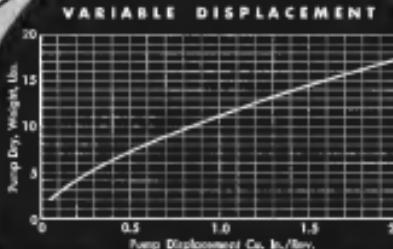
Midwest Air Transport Service will go back into the congressional spotlight with its proposal to begin buying DC-8 or 707 jet transports, basically passenger aircraft designs heavily and expensively converted to cargo versions. The keeping landing gear and strengthened loading capacity of these jet transports sought for MATS use will be a highly controversial issue, both on Capitol Hill and within USAF. There is a strong faction in USAF that makes an excellent case for the use of turbofan-powered heavy logistic aircraft specifically designed for cargo operations.

There is a growing groundswell of concern on Capitol Hill over the ongoing talks by the House Space Committee headed by Chairman Brooks. Last year, this committee, headed by Majority Leader John McCormack did an outstanding job in handling legislation that created the National Aeronautics and Space Administration. This year, his hurry datum in majority leader prevented Mr. McCormack from continuing leadership of this committee. With 19 legislative committees assigned to it and a new chairman, this committee faced an admittedly difficult task in equating the excellent record of the previous committee and its predecessor staff.

Chairman Brooks has so far deployed a shotgun approach to the serious problems of getting the national space program organized and accelerated. In several cases, the committee has stayed far from its legitimate terrain. An example: investigation of the Nike Zeus anti-ICBM program is clearly an business of the space committee. It is obviously the concern of the Armed Services Committee. We strongly recommend that the House Space Committee and its chairman make a serious reappraisal of their program before they lose too much of the reputation for solid, sensible contributions that that group enjoyed last year. They should also strongly consider the amount of precious time wasted by the unnecessary duplication of testimony before a variety of groups by the key people in these programs.

As the political temper of Capitol Hill becomes hotter with the approach of the 1960 presidential election, aviation leaders will face an increasingly difficult problem of getting these vital issues debated and legislated with out the stress and strain of partisan politics. We hope they will make every effort is important on Congress the vital strength that aviation now adds to our national strength, from fast transports to gathering new wealth from the stars. With this in mind, it should be obvious that a sound national aviation policy will best serve both parties and the people who support them.

—Robert Hote



Model	Displacement in liters/min	Rated		Max. RPM	Rodless Dimensions	
		PSM	PSM		rodless	Length
P196	1.795	4000	25.4	5000	8.750	8.320
P209	2.63	4000	27.3	5000	9.320	7.250
P81	3.65	4000	31.0	6000	11.673	6.625
P11	3.65	12000	7.0	16000	3.000	4.250
P11	.815	12000	5.5	16000	2.753	3.025
P364	.864	12000	3.2	16000	2.325	2.325
P344	2.41	12000	2.1	16000	2.325	3.025

## A NEW FAMILY OF . . . HYDRAULIC PUMPS WITH THE LOWEST WEIGHT DISPLACEMENT RATIO

For Aircraft, Missiles, and Systems!



Model P196



Model P11

by utilizing space not available in other designs to incorporate the variable displacement feature and serve system. Plungers operate on an inclined axis to provide center-load reverse force and are arranged such that the sole loading on each plunger is minimized when the maximum overrunning torque occurs.

Fixed displacement pumps are also available in all models with reduced weight and envelope dimension.

The proven experience of Bessey in manufacturing thousands of sheet metal pressurized fuel systems for reciprocating engines and fuel supply pumps, fuel systems for aircraft engines, hydraulic pumps, and hydraulic systems for high performance missiles assures you of a quality unit at a price that matches the high reliability of the Bessey line.

FOR 3000 AND 4000 PSI  
SPEEDS TO 16,000 RPM

This new family of rotary plunger pumps is furnished with forged aluminum housings for fixed displacement ratings up to 4000. Thousands of hours of endurance and qualification testing, as well as flight tests, have proved that these new pumps will satisfactorily handle all MIL Specification hydraulic fluids including Oxyline 8515 and will conform MIL-P-14900 specification requiring 150 hours of endurance. The low weight displacement ratio is accomplished.

**BAUDER PRODUCTS**—reciprocating hydraulic pumps, hydraulic components and air systems, engine fuel pumps and fuel system components, pressure bodies and bellows assemblies, thermometers and related sub-assemblies, and fuel system manufacturing and testing.

Hamilton Division

HAMILTON, OHIO







## ••• RADAR SIGNALS FROM SPACE •••

When any test fires a rocket into the fringes of our atmosphere, sending signals to the ground we'll know its position and trajectory from signals beamed to earth by a tiny radio transponder.

The Stavid designed and Stavid-built beacon receives transmissions from ground radar sets on the ground and develops small pulses for discrimination and tracking. The system provides for the passage of data in both directions and permits tracking at greater distances than possible. This development represents a new great achievement in techniques advanced by Stavid engineers, who are today advancing the state-of-the-art in electronic space engineering.

### OTHER AEROSPACE PRODUCTS INCLUDE:

- High power Modulator Transmitter for Radar Det. RDRHQ-19
- Search and Intercept Radar DA-5000-100-0000
- All Weather Radar Pulsed Scanning System



George E. Symington, Jr. Aeronautical engineer and test director in the development of the Convair B-58 Hustler, the Convair F-102 and the Convair F-106. Vice President, Electronics, Space and Varying and Aiding Services.

**STAVID** Engineering, Inc. Pittsfield, Massachusetts

*Imaginative Electronics...*

Outstanding engineers and scientists are needed to explore new opportunities on Stavid's exciting systems engineering teams.

## Washington Roundup

### Renegotiation Proposal

On another front Ray Clegg King (D-CM-5) proposes to open negotiations with the Soviets. In the light of the recent test-ban agreement, he would like to open the door to a further expansion of a full spectrum of facts and measures before coming to specific profit under agreed terms. It also would improve public reports on U.S. arms orders. Because it is not clear now, King declared, "the Congress, the public, and the administration lack the kind of knowledge of intergovernmental relations that may develop in the administration of the act resulting in validation and dissemination regardless of an arms test moratorium."

King is a member of House War and Peace Committee which will soon consider continuation of the renegotiation bill, due to expire June 10. The bill also would:

- Limit export profit measures on sensitive-type contracts. The restriction would be carried to the agreed profit "plus 10% of the amount of these profits."
- Authorize review of tax credit decisions on reorganization bills in the U.S. Court of Appeals.

### Hardened Bases for Atlas?

Defense Department is again considering a proposal to provide Air Force with the necessary funds to build the spaceport launching area for the Convair Atlas intercontinental ballistic missile in enough sites to not be plagued by the Martin Titan ICBM in view of the growing Soviet missile threat.

### Joint Chief Appointments

Gen. Maxwell D. Taylor will retire at the expiration of his term as Army chief of staff on June 10 to be succeeded by Gen. Lawrence D. LaMarr, new Army vice chief of staff. In assuming his retirement the White House said that Taylor, presently completing his second tour as chief of staff, had told Defense Secretary Robert McNamara that he did not want to serve a third term. The White House also stated that Gen. Taylor was giving up the stepped-down position of public affairs representative in the fiscal 1960 defense budget (IAW Aire 16, p. 26).

In assuming Gen. LaMarr's appointment, President Eisenhower also nominated an Army Gen. Nathan F. Twining for appointment as chairman of the Joint Chiefs of Staff, a post he has held since Aug. 13, 1953. Adm. Arleigh A. Burke is a second brother from the chief of naval operations, and Gen. Thomas D. White is his second brother as Air Force chief of staff. The fifth member of the Joint Chiefs, Marine Gen. Randolph Pate, finishes his second two-year term as Gen. II. He is expected to retire at that time.

### Non-Skied Review Disputed

Major tank crews are taking a dim view of non-skied review policies. And by 15 weeks scheduled operations will fail to satisfy the demands of the Army's large heavy Air Corps investigation. The Good Government Board offered a "modest, sensible proposal" to the congressional committees in the case, the algebraic complex, and should hesitate before dropping the gavel-finish still further. —Washington staff



# Nuclear Rocket Effort Acceleration Urged

Washington—Acceleration of the U.S. program for development of a nuclear rocket that will be targeted into space by Thor and Atlas-Centaur during testimony before the House Committee on Science and Astronautics.

The testimony was made in a joint statement by W. F. Reinhardt, chief nuclear propulsion engineer, and J. J. Nengard and Myron Lewis, nuclear propulsion project engineers, during the committee's inquiry into rocket and space vehicle propulsion systems.

Later, T. J. Dixon, chief engineer of North American Aviation's Reinhardt Division, told the committee that a nuclear-powered rocket could be completed within 3-5 years if funding for Project Rover was increased from \$25 million to \$40 million, a request he and Reinhardt has made available to members of Congress to accelerate the nuclear weapons research project.

The engineers suggested that an accelerated program be continued to produce a test vehicle in order to provide more practical engineering data on costs and performance.

The nuclear rocket can be used, the engineers said, to move from one orbit around the earth to another planet, or to an orbit about the moon. The engineers said another nuclear rocket, a three-stage rocket could make the trip in a specified time of less than five years. If the time specified was from five to eight months, only the nuclear rocket could make it, while having eight months, both could make it, but the

To illustrate comparative costs of

plasma vehicles in 300-mm orbits, the Thor step-up interplanetary travel, the Thor step-up to the moon, and the nuclear test vehicle that would cost \$660 million if the maximum of payload lifted to that height. Total cost for the test vehicle would be \$3.2 billion. Test with shells would total \$210 million, or 5% of the current defense budget. 100 shells would be \$2.1 billion, 3% of the current defense budget.

To send a 10,000-lb thrust nuclear vehicle or 280,000-lb chemical vehicle would have to be placed into a 20-mm orbit around the earth. At the assumed figure of \$660 a pound, it would cost \$860 million to get the nuclear-powered vehicle in orbit and \$2.2 million for the chemical vehicle. Cost of the vehicles are not compared because of the present lack of engineering data on nuclear vehicles.

T. J. Dixon, chief engineer of Aerobee Division of North American Aviation, Inc., told the committee that, based on the high performance potential of nuclear rockets, larger payloads can be delivered with fewer stages, opening the door to larger interplanetary and the establishment of planetary bases.

To lift a 90-ton payload from earth to an orbit around Mars and return to an earth orbit, Dixon said, would require a single high-energy chemical vehicle with a takeoff weight of 30,000-lb. It is compared with a two-stage nuclear rocket and a takeoff weight of 340,000-lb.

Richard D. Gudler, vice president of the solid rocket plant of Aerojet-General Corp., told the congressional development of both solid and liquid nuclear fuels with adequate shielding to soon require basic research leading to the next step in the development of space. He said that, eventually, with reorganization of additional resources, it may be possible, in determine which type fuel is better suited for space missions.

"At the present time," Gudler said, "we are in a way of advancing with solid propellants as exhaust velocity as great as can be obtained by liquid hydrogen and liquid oxygen or liquid fluorine. On the other hand, propellant performance is 80% with the following factor in increasing the type of power plant for space missions. I personally believe that chemical rockets will not be supplanted in space exploration for many years to come and the present characteristics of solid propellants will enable them to compete effectively with liquid propellants."

John M. Martin, general manager of the Aerojet-Powder Co.'s Evaluation Department, Washington, D. C., said his company has conducted extensive research aimed at reducing weight of inert parts of rocket engines.

The new engine, which is the 300-mm diameter, 100-mm long, 100-mm wide, and 100-mm high, will be used for the Thor-Centaur and Atlas-Centaur vehicles. The 300-mm diameter engine will be used for the Thor-Agena and Atlas-Agena vehicles.

use research aimed at reducing weight of inert parts of rocket engines.

He told the committee that Reinhardt has developed a glass-coated plastic fuel case that has demonstrated a number of advantages, particularly for fire protection. The glass is heat and, especially, to weight to insulate the fuel. Its strength is comparable to that of carbon fiber-reinforced plastic. Its strength-to-weight ratio exceeds that of any known metal, Martin said.

S. K. Hoffman, vice president of North American Aviation, Inc., and general manager of the Rocketdyne Division, and Rocketdyne has performed all its production and experimental programs with stable propellants, giving performance "equal to and in fact slightly better than that attained with liquid engines and liquids."

A continuous research and development program should produce a rocket with a performance that is within 10% of that attained with the best high-energy propellants, Hoffman said.

Continuation of liquid-propellant engines and their hardware to use with stabilizers is "rapid, straightforward and relatively inexpensive," Hoffmann said. "We therefore conclude that for the very high thrust, last-stage engines, liquid oxygen will be used, certainly, with conventional as stabilizers to follow the orbital preflight date."

A continuous development program on all large engines for space applications, ranging from boosters of 30,000 to 100,000-lb thrust to upper stages of 5,000-lb thrust and upper, could "contribute to a situation in which at least the basic engines about these categories would mature about their original design ratings," Hoffmann said.

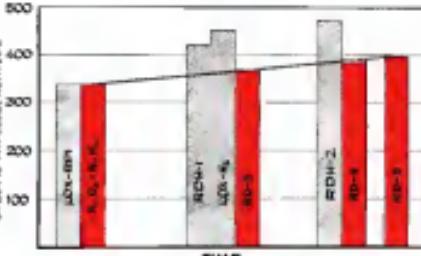
Hoffman also argued more simplification effect. He said a Rocketdyne stabilization program had resulted in cutting major engine components from 85 in 1955 to 70 in 1958, and a 1960 model now is the test stands for only five major components.

Reviewers of boosters will make big improvements in cost advantages, he said.

He indicated recent experiments may have led to a liquid oxygen and liquid hydrogen system developed by Rocketdyne, but that the fuel stability is long, in 10 years, however. "It's going to be more expensive than throwing them away," he urged since work on answers will require

Das A. Reinhardt, president of the Aerojet-General Corp., told the committee the most pressing problem is program schedule.

• Need to reduce weight, complexity and cost of first stage engines. Solid engines of 200,000-lb thrust with propellant diameter of 300-mm are now in development. The "most recent



IMPROVEMENTS in specific impulse that may be expected with high-energy propellants. Dotted bars range from approximately 180 to about 450-lb of thrust per pound of propellant in the Rocketdyne chart. Requirements to be expected from stable propellant combustions are shown in red. The four bars for RODB are a fast. The other bars show RODB or RD designations which are Rocketdyne's own for company high-energy propellants.

efforts of the chemical industry to produce new fuels and oxidizers, at the propellant manufacturers, to develop means of preserving stable propellants until the engine fabrication to develop means of insulating high-temperature, corrosive and operating loads." In liquid, however, engineers expect of liquid fuels tested high performance potential is limited, but more important are improved reliability and reduced cost. Cutting hardware weight by a factor of ten in weight, i.e., 50 million a shot in a vehicle shot, has a 100,000-lb thrust propellant weight, 30,000-lb of liquid oxygen weight, 20,000-lb of liquid hydrogen weight, Reinhardt said. "Somewhat less sophisticated designs that allowed 'single propellant' methods of construction might cut hardware costs by a factor of three without any great reduction in weight. Recoverable first stages might cut half again as much per pound but a major part of the orbital cost would still be saved if the booster could be used half a dozen times or perhaps more."

• Liquid oxygen need for a comprehensive program to develop operational capabilities of liquid oxygen and liquid hydrogen upper stages, liquid hydrogen and liquid oxygen or liquid propane and propane during about 10,000 to 300,000-lb of thrust.

• Need for high-performance stable propellants for use in solid rocket boosters, when storage might be necessary for periods of several days to a year or more.

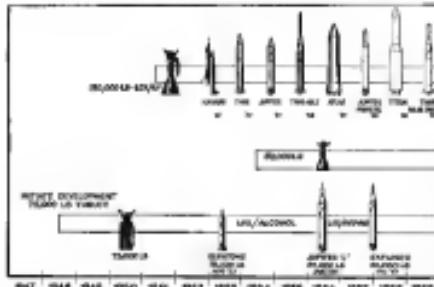
• Urgent need for a larger dollar effort in nuclear propellants for space use. "I don't think we're moving as fast as we can and should," Reinhardt said. "Our clear direction is 'urgently needed for long-range space missions such as

manned probes to Mars or Venus and beyond, since they offer the only really known means of accomplishing such missions without the expenditure of truly astronomical amounts of propellants."

• Immediate initiation of a technical development program to demonstrate the feasibility of an integrated electrical propulsion system." Reinhardt said. "I believe that a program to develop a hybrid electrical propulsion system within the next few years will have reasonable opportunity for success," but that funding for the research, development and for the test facilities should be as low as possible in the near future to a much larger effort."

B. S. Young, vice president of Aerojet's liquid rocket plant at Sacramento, and the liquid rocket field has been hampered by lack of propellants because the chemical industry has not provided new fuels. He said he would like to see more research and that it probably would be best done by the chemical firms. Young said, the U.S. should start to consider seriously a 10,000,000-lb thrust engine, which "you might have to build right at the launching site, to get the propellants there."

D. H. W. Rutherford, vice president of Thiokol Chemical Corp., and there is a "real design" that the U.S. will do in the propulsion program what it has done in that and other defense fields in the past—decide what we have enough. "Nuclear and chemical propellants should be pursued and given priority," he said, over thought "if we get into space within the next few years we will do what we have today—chemical propellants."



ROCKETEER CHART shows development of liquid-propellant rocket engines in the Thiokol-Powder Co.'s Evaluation Department, Sacramento, Calif., and its successor in Thor, Jupiter, Atlas, Titan, and space vehicles. The 300-mm diameter engine was used in Thor, Jupiter, Atlas, Titan, and space vehicles. The 300-mm diameter engine was used in Thor, Jupiter, Atlas, Titan, and space vehicles.

# Synthetic Chemicals May Replace Petroleum Fuels in Rocket Engines

By Michael Yester

New York—Completion of field evaluation tests next summer will at Rockwell's Division of North American Aviation, Inc., mark the replacement of RP-1 petroleum fuel by synthetic chemicals in large liquid rocket engines and, in the early stages of development, in the Atlas ECM (ECM) rocket.

For the past 15 months, Rockwell researchers have been evaluating diethylbenzene, a synthetic chemical that can be made in a hydrogenation of the isomers of isooctane, as part of the Air Force's continuation program. The chemical experiments are progressing, and the success of the approximately two dozen other fuel possibilities evaluated by Rockwell to date and, consequently, its evaluation has been carried further. Both Air Force and Rockwell, however, strongly want propulsive suppliers that make fuel at the rate that this would be generated.

Fuel delivery on 450,000 lb of diethylbenzene purchased by the Air Force for the test has been started. Chemical Co. and Union Carbide Corp. are making the fuel. Rockwell is expected to complete its evaluation in another 12 weeks. The company will then make its report to the USAF's Ballistic Missile Division, which then will decide on the merits of the synthetic as a possible successor to RP-1.

RPMD's decision will be a difficult one, requiring a great deal of careful consideration and time. It will have to weigh the engine's high price, approximately 30 more than that of RP-1, against improved engine performance. Rockwell engineers do not consider the cost cut of low-pressed diethyl-

benzene down with the corresponding loss in thermal output of liquid rocket engines by the varying chemical and physical properties of different batches of petroleum distillates such as RP-1.

A review of natural RP-1 is also tilted out of trade petroleum over a comparatively narrow boiling range. Developed in part of the same petroleum products improvement programs, an distillation range was defined so that it would contain down of the aromatic hydrocarbons found in the entire jet fuel and most of the cyclic hydrocarbons which serve both to show more thermal stability, lower auto-ignition temperature and high thermal efficiency.

At first, Rockwell selected RP-1 as the source of the desired cyclic hydrocarbons. Later, as more oil companies started producing the fuel, its properties began to vary significantly from batch to batch. One batch, for example, might have more straight-chain hydrocarbons and lower thermal stability than another. Lesser thermal stability meant heavier coking and power costing. Beauty also would vary, and, as a result, use would not be limited to the most fuel level at the part.

For the sake of economy, still to change of process, the Air Force turned to Rockwell to find a synthetic product as a solution to the problem of obtaining uniform quality. This is when Rockwell sat down and upon the idea of going to a synthetic material to get reasonably reproducible characteristics when they depend upon the various of nature and distillate volume.

To simplify the substantiation of a new fuel in an already developed missile system, the new material would have to have chemical and physical properties close to those of RP-1. Rockwell researchers then chose the most cyclic hydrocarbon distillates, diethylbenzene, diethyltoluene and tetrapropylbenzene. (AWW Mar. 31, 1958, p. 24). Diethylbenzene was favored over a potentially the most readily available (current U.S. imports) is octane, due to the fact that minimum demand of the Atlas program, meant to make and start

No official announcement of mission and overall responsibility for ground environment for Minuteman has been made by Air Force's Ballistic Missile Division, which has cognizance of the program, but indications are that Boeing will be given the job, along with its associates and test sites. However, major components of the ground environment may be imported and maintained for Boeing by IBM with other industry members.

Diethylbenzene can be made simply by the hydrogenation of diethylbenzene which is produced along with the ethylbenzene required to make styrene. Major styrene problems, namely, Dow, Koppers, Monsanto, Shell and Union Carbide, are generally concerned the diethylbenzene to the desired ethylbenzene, but it could

be pulled out of the styrene process stream with little effort and converted to diethylbenzene.

Diethylbenzene is a water-white liquid of the empirical formula  $C_8H_{10}$  with a molecular weight of 110. Its density is approximately 0.865 lb/cu in. and its R.P. is approximately 80 and 81. Its heat of combustion is 18,630 Btu/lb. Its  $D_{40}$  is approximately 18,380 Btu/lb. Its  $D_{40}$  is approximately 18,380 Btu/lb. Its  $D_{40}$  is approximately 18,380 Btu/lb. It has a freezing point below -130°, a flash point of 116°, and produces only slight coking. Diethylbenzene, in effect, could be substituted in the Atlas engine without requiring any changes.

Shell Chemical is now quoting the material at \$1.30 a pound a pound a few thousand pounds. Should a major market develop, however, Shell and others believe the eventual price would come down to approximately 75 cents a pound or about \$1.00 a pound. The price of RP-1 will be approximately 75 cents which gives it a decided edge. Wide availability of supply in another advantage of RP-1. It is for these reasons that the government is continuing its interest in petroleum distillates as evidenced by the petroleum products improvement program.

The chemical industry is hoping that diethylbenzene makes the grade and is specified as RP-2 suitable for both rocket and jet engines.

## Minuteman Funds

Being Aspinwall, Pa., has been allotted \$100 million for Minuteman advances and ballistic missile research and development. This is the first time that the Air Force has ever allotted this kind of money, and, for which Boeing is prime contractor, and this will include a portion of the very extensive ground equipment plan. (AWW Mar. 15, 1960, p. 60).

Reporting to the public that the first year plan will be as follows for fiscal year 1960-1971, Air Force: \$100 million for Fiscal 1960-1951, for Fiscal 1962-1953, and for Fiscal 1963-1954, and for Fiscal 1964-1955.

No official announcement of mission and overall responsibility for ground environment for Minuteman has been made by Air Force's Ballistic Missile Division, which has cognizance of the program, but indications are that Boeing will be given the job, along with its associates and test sites. However, major components of the ground environment may be imported and maintained for Boeing by IBM with other industry members.

The engineers, in present, is watching closely the final resolution of the ground environment plan responsibility with an eye to participating with Boeing as a team member or subcontractor.

Robert P. Morgan, Jr., a project man-



TWA Changes Fuselage Markings on 707 Jet Transport

TWA World Airlines is retiring a red nose design on Boeing 707 jet transports scheduled to start transcontinental service last Friday between New York City and San Francisco. Cabin capacity and a load factor will be 50, 45 min., nonstop, 4 hr. 40 min. Seating configuration will be 40 first class and 65 coach seats. (AWW Mar. 16, p. 87).

## Engineers' Charge Disputed by ALPA

Washington—Air Line Pilots Assn. last week filed a "summarized and captioned" charge to the Flight Engineers International Assn. that a group of Eastern Air Lines pilots violated flight safety regulations (AWW Mar. 16, p. 38).

Reporting to the public that the 200 pilots filed a complaint with the Federal Aviation Agency, the state of Maine pilots are accusing the group of flight engineers and co-pilots of violating flight conditions, guidelines for the pilots' actions and the cockpit discipline can be traced to faults on the part of both flight engineers and Eastern operations manuals. Many engineers, they said, have failed to accept their proper position as flight crew specialists and have resisted pilot-centered authority as established by the Civil Aeronautics Board. The ALPA complaint also includes deficiencies in the company's manuals which fail to spell out the proper standards of cockpit discipline. (AWW Mar. 16, 1958, p. 60).

Eastern Air Lines filed its flight plan that rugged failure for January said there three times the number required for the same month of 1955. Total promotion manuals of 35 pilot positions, as compared with only 16 for January of the previous year, along with 10 flight formations of Alaskan Airline 747 transports, engineers said the Eastern is responsible for "deleterious" operational problems of the four aircraft. The complaint also charged that the company's manuals are not consistent with the standards of the Civil Aeronautics Board.

The engineers' group, however, reiterated its stand that flight crews, not pilots, be maintained by following company operations manuals written in conjunction with aircraft manufacturers and the Civil Aeronautics Board. In answer, George R. Petty, Jr., president of the engineers' union, and TWA has no intention of infringing upon the pilots' reserved authority but that if the pilots' "final, or complete, do not constitute sufficient cause of safety regulations, and we do, then it is an appropriate place (the FAA) where that can be decided."

Initial issue of the current dispute between pilots and engineers is that the subtitle of some captions in covering items flight engineer duties and action to operate aircraft in their absence with company operating manuals in mind. Eastern flight engineers and as a source of major maintenance problems.

Discussions of pilots with current flight engineer procedures they claim has been most apparent to the use of maintenance of engines on aircraft and failure to maintain proper cylinder head temperatures.

Eastern Air Lines filed its flight plan that rugged failure for January said there three times the number required for the same month of 1955. Total

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## Space Council Staff Appointments Urged

Washington—Despite action in April naming a professional staff for the National Aeronautics and Space Council as provided by law, no action on the first report of the Special Senate Committee on Space and Astronautics is to be taken next week.

The special committee succeeded in the Special Senate Committee on Aeronautics and Space Sciences, and that, without much difficulty, the Senate Select Committee on Space and Astronautics is to be taken next week.

The committee pointed out that no legislation has been referred for the position of executive secretary and that it has not been able to ascertain just what programs have been made at the guidance of the Senate Select Committee on Space and Astronautics. The committee was created by the National Aeronautics and Space Act of 1958 and members were appointed by presidential order.

Offices recommended in the Space and Astronautics final report include:

Relationship between the Space Council and the Federal Council for Science and Technology, being created by the White House will require further analysis. The report said the suggested initial membership overlaps that of the Space Council is a number of instances and urged the Standing Committee to determine if duplication exists and to what extent there two committees can and will meet needs of Congress.

## ECM Decay Study

Los Angeles—Aerospace Systems, Inc., has been awarded a \$2,327,000 contract by the Air Force Ballistic Missile Division for development and testing of decay to effect certain ECM devices.

Pratt & Whitney Division, a major contractor and major element of the company's booster missile program will be granted at New England, Rhode Island, where Aerospacem is building a permanent testbed and research center.

Robert P. Morgan, Jr., a project man-

# ASME Warned Against Space 'Panic'

Los Angeles—Special interests have been identified at the expense of national interest in U.S. defense and space programs. Ross Atch, John E. Clark, a principal director of the American Space Propulsion Agency, told the American Committee of the American Society of Mechanical Engineers here.

Clark said the U.S. has the expertise and the technical talent to catch up with Russian technology if it concentrates upon special interests and group needs can be controlled. "But we must admit the fact that the Russians are ahead of us in this field (space technology) because of our late start. The safest way to remain forever behind is to be paraded into each program of a glorious future and expect the best with."

Clark advised against the creation of an agency for space technology with power equal to the Atomic Energy Commission. There is no need for a separate agency, he said, because the approach was successful in dealing with an agency which it would be equally successful in continuing a program to move to space using many complex vehicles, each with a different mission, he explained.

Clark said that defense problems in technology require, if not a new division or a new thinking, then at least a degree of frankness and boldness in our thought patterns which might be applied anywhere by the American people at large.

Locating of lunar probes and satellites at 100,000 ft. and 300,000 ft. could be accomplished, he said, in a few heating test stage cycles, Peter G. Keyes, of General Electric's Flight Propulsion Laboratory, said.

## Launching Platform

Such a launching platform would have the following advantages:

- Reduction in low-fuel-use requirements such as blockheads, and gimbals between. Existing large air bases could be used.

- Reliability of system would be enhanced since the air launching test stage could be checked out prior to launching of the second and subsequent stages.

- Substantial savings in a program during the course of which five or more launches were scheduled, since the first stage could be recovered.
- Ability of booster to fire itself in boost mode.

Kappa mission, the air launching launcher in a North American 3-71 type aircraft which would carry the second and subsequent stages, page 42, would weigh 260,000 lb., have six 40,000 lb. thrust engines (available

by 1980), and carry a 240,000 lb. payload, presenting a total orbital stage weight of 160,000 lb.

Proposed, he said, a recoverable orbital launcher first stage would weigh 150,000 lb., more, depending on mission, he stated.

ASME members at the conference also heard an propulsion system types for aerospace. Main probes proposed by E. S. Knutson and V. E. Lounis of Rockwell-Douglas Division of North American Aviation. For analytical purposes, they assumed that the Mars trip would follow a minimum energy Hohmann transfer ellipse and would be started by the proposed 1.5 million lb. thrust booster which would place upper stages weighing 25,000 lb. into a 190 mi. intermediate orbit. These were used as the target probe weight and point of departure for the space program's system studies. They were used to a low altitude Mars orbit for close observation of the planet.

Of the six types, all except liquid hydrogen nuclear propulsion and ion propulsion were discarded possible early design concepts. Two-stage fluorine-hydrogen system was found to out-

perform the other three potential early developments.

Gas velocity increments needed to go from the Earth into the celestial orbit to the Martian orbit were:

- 31,648 fpm to escape the 300-mi. per orbital orbit and go into an elliptical trajectory converging Mars.
- 150 fpm to enter correction after entering transfer ellipse.

- 3,779 fpm increment to make the plane of the probe trajectory parallel to the plane of the elliptic orbit in the plane of the planetary orbit.
- 250 fpm velocity increment for entry into the planet transfer maneuver.
- 400 fpm velocity increment to enter target atmosphere.
- 300 fpm velocity increment to establish Mars orbit.

## Thrust Valve

With two exceptions, thrust valve is that needed to give initial thrust weight ratio of 0.5 when departing the terrestrial orbit and entering the Mars orbit. The exceptions were a solid propellant engine which required higher thrust than a jet to get about burning time to just get around nozzle and ion engine which is limited to an acceleration of about 0.002 g. Solid propellant design requires three stages, liquid chemical propellants call for two stages and both nuclear and ion systems use single stage design. All liquid systems use liquid pressure fed.

In the fluorine-hydrogen system, low density of the liquid results in a large volume hydrogen tank. To overcome this, a high specific-impulse nozzle was used and a chamber pressure of only 100 psia was selected to keep hydrogen tank pressure from becoming too high. Low chamber pressure requires higher thrust chamber and ion-motor mass over all is set at 25 lb., even though space operation dictates very high mass ratio nozzle. Propellant tanks are spherical for minimum weight. Fluorine and hydrogen are pressurized by compressed helium gas stored at 4,500 psi. Helium, he said, is present made hydrogen tank to maintain low temperature these storage conditions thereby cutting heat loss. Helium is also embedded in plastic frame which reduces in both insulation and structural support.

Hydrogen, ammonia and hydroxide were chosen for a reusable liquid propellant space propulsion system. The combination of hydrogen and ammonia system is needed. Design of the system is quite similar to that for the fluorine-hydrogen system with few exceptions. High density of propellants allows use of best engine/nozzle ratio and results in small volume, lightweight tanks per-

forming power-fed operation at chamber pressure of 150 psia. Decreased thrust chamber exit rate weight of 351 lb. was also noted.

A hybrid propulsion system was also used with solid bipropellant (solid monopropellant and liquid fuel/nitrogen tetroxide). Ignition is by ignition of the liquid oxidizer over an explosive initiator. Low chamber pressure and exit ratio for a nozzle exit area of 30:1. Initiator is used at nozzle exit for thrust vector control. It might prove necessary to close the nozzle during the coast phase to prevent vaporization of the solid fuel in the vicinity of spurs. Feasibility of the regeneratively cooling nozzle with chlorine-tetroxide hot jet to be proved.

## Solid Propellants

Solid propellant system is relatively inexpensive, maintenance-free, reliable, modular and polyvalent, but with initial difficulty. Nozzles are cored by displacement which minimizes a nozzle exit pressure to assist ignition and prevent pre-ignition combustion during coast. Thrust vector control is provided by jetronic rings as in the Polaris missile.

Nozzle system would operate at extremely low chamber pressure of 20 psia because that results in greater dissociation of the hydrogen propellant fuel which lowers molecular weight and therefore increases specific impulse. It results in a large thrust chamber and a small 10:1 nozzle exit ratio. Nozzle is mounted and is constructed of the same materials as the nozzle.

Regeneratively cooled, the responsible because of the low hydrogen has, rate initiator is used for first order control. Radiation shielding is provided with leaves to prevent deleterious radiation heating of the liquid hydrogen, thereby locking off enough to maintain tank pressure. Fact that hydrogen pressure itself will allow complete evaporation of the propellant for the nuclear reactor can operate with either liquid or gaseous hydrogen.

Ion propulsive system uses at the working fluid pressure pounds per sq. in. 12% of gross weight. Low thrust level and relatively low combustion pressure allows light-weight ion engines. Thus the ion system is very efficient. Electrostatics. Electrical power would be produced by a solar-kinetic generator which in turn would be powered through a solar-kinetic cycle from a nuclear reactor. Thrust would be about 3.5 lb. Best design specific impulse is about 9,000 sec.

After ion-kinetic ballistic can use already has the capability to place mass in orbit, providing capsule in within the 2,000 lb. weight limit established by NASA.

Calibration by Martin Goldsmith,

research engineer, Rand Corp., revealed that the Atlas sustainer produces about 30,000 lb. thrust at altitude, and would provide the last stage burnout weight of 17,500 lb. with a peak acceleration of 1.5 g. The total lift contributions in a lift-off gross weight of about 250,

000 lb. and a mass ratio of 0.95. Goldsmith and Little can do more about the tremendous acoustic and vibration level of Atlas except to isolate the cause. As for the 6.5 g acceleration, more with proper siting and airing out, patrons could doubtless add.

He said that liquid propellants have a slight edge over solids at the present state of the art. Solid trend is flat in an explosive manner, while liquid propellants but at a less rapid rate, important if it is to end up to be given enough time to storage in case of war.

## Missile Mobility

Mobility will be the prime consideration in ground support equipment. Howard K. Hartman of Ford Motor Co., Dearborn, Mich., said mobile equipment must be designed with mobility in mind.

Hartman applied the following arguments to mobile mobility requirements:

- Inertial missiles, even though they may have a range of hundreds of miles, may be forced to maneuver quickly on terrain unsuitable to conventional types of automotive equipment. Driving miles with a crawler from the firing site would delay the launching, providing effective countermeasures.

- Mobile systems should operate at extremely low chamber pressure of 20 psia because that results in greater dissociation of the hydrogen propellant fuel which lowers molecular weight and therefore increases specific impulse. It results in a large thrust chamber and a small 10:1 nozzle exit ratio. Nozzle is mounted and is constructed of the same materials as the nozzle.

Regeneratively cooled, the responsible because of the low hydrogen has, rate initiator is used for first order control. Radiation shielding is provided with leaves to prevent deleterious radiation heating of the liquid hydrogen, thereby locking off enough to maintain tank pressure. Fact that hydrogen pressure itself will allow complete evaporation of the propellant for the nuclear reactor can operate with either liquid or gaseous hydrogen.

Satellite survival mobility is also desirable to eliminate establishing the satellite in a fixed orbit. The mobile system provides mobility to maintain and enlarge growth and must be carefully designed and tested to overcome these effects.

Considerable attention, said Hartman, is being given to vehicles weighing up to 10,000 lb. and capable of breaking fast stage weights of from 250,000 to 500,000 lb. Units of such weight he envisioned as being in the 1,500,000 lb. class. Hartman said they may use mass-lage wheel or airframe transports or even sit-down launching from manufacturing or launching site.



# Defense Management Contracts Scored

By Katherine Johnson

Washington—Defense Department officials from Congress and the Office of the Budget to review use of contracts for management and operating services and tighten its control over them.

Rep. Chet Holifield (D-Ga.), chairman of the House Military Operations Subcommittee, now completing a study of management of the missile and space programs, will last week that "it is obvious that when a crash program is under way that certain normal procedures have to be set aside. But this practice of outside contracting should not be allowed to develop into a way and never stop."

## Budget Bureau Proposal

Monique Stasz, director of the Budget Bureau, has submitted a memorandum to the Defense Department and other agencies proposing the establishment of certain strict check management and operating contracts should be notified.

Nowhere before the Holifield subcommittee has focused on the increasing use of such contracts by the Defense Department, including switch to Institute of Defense Analysts and Rand Corp. for technical problem-solving; Pan American World Airways for operation of the Atlantic Missile Range; Space Technology Laboratories for management of USAF's Infrared missile program; Federal Electric Corp., a division of International Telephone and Telegraph Co., for operation of the DSW Line, with a number of other management and operating contracts.

Stasz now believes that these types of contracts have been used primarily to test the performance of functions requiring specialized knowledge and experience in large-scale industrial management or in conduct of research, and when general need has been required in the organization of a new program or service. He said, however, that the use of such contracts, including "the design, supervision, and control of procurement programs" and "functions of determining basic government policies."

Management and operating contracts should not be considered suitable, Stasz said, unless:

• "Contractor operations are judged to be more economical than direct operations by the agency, or where probable increased cost of contractor operations is likely to be more economical than direct acquisition by the agency, or where probable increased cost of contractor operations is likely to be outweighed

by a significant increase in effectiveness of operations."

The agency has no essential need for the services or supplies which would be required if agency personnel performed the function, as the agency cannot perform the function at the standard of excellence required or within the time limit required."

Stasz also proposed a strict of regulations for class supervision of management and operating contracts—preclude approach of performance audit, etc.

William Faison, chief of the Budget Bureau's Office of Management and Organization, told the subcommittee that the Stasz proposal "would rule out some of the features" of USAF's arrangement with Space Technology Laboratories involving supervision of government, personnel and functions of design, procurement, production and operation contracts being used.

Holifield suggested that management and operating contracts be used "as an occasional procurement, personnel, design and no costs." The subcommittee, he said, had planned extensive data sharing that salaries of technical personnel working under outside contracts are substantially higher than those of government employees doing similar work. Subcommittee members also have raised a question of conflict of interest, particularly in connection with DIA which draws personnel from directly to the Air Force's Advanced Research Projects Agency. Robert Roberts, subcommittee counsel, said that wholesale transfer of USAF's Infrared missile program to FARPA "at this time gives a tendency to dominate the basic policy of government."

Air and Navy prepared their concept of direct service procurement of missile programs as proposed in the set aside clause of Air Force missile management program by Space Technology Laboratories in testimony before the Holifield group.

Air Force had previously made its

decision of an approach at subcommittee hearings (AVN Feb. 16, p. 51). Deputy Secretary of Defense Robert S. Mosher also endorsed Air Force's 1954 arrangement with Space Technology Laboratories, and said it would be well-made continued with STL as the ballistic missile field, but would not be extended to other areas. It was necessary only to demonstrate to advance the ICBM program as rapidly as it was advanced, Mosher told the subcommittee.

"I wouldn't say that it would be a new way to handle even programs, but in view of the points and arguments, and other problems of the ICBM program, I think it may be. The Air Force spent for themselves. I do not see a need to do this for this missile program, but in the program and that it is not important to it. Neither do I see any broad extension of it."

Gen. Elmer Nau, Assistant Secretary for Materiel, told the subcommittee: "Management control has been retained fairly within the usual organization. Experience has proved that only through the ability to exercise a high degree of responsibility, and management control over research, development and procurement can the delivery of material, satisfy the most tasks, at the earliest time and at the lowest cost."

## Timeline's Welcome

Major Gen. J. B. Medina, head of Army's Strategic Missile Command, elongated the "Timeline" of the subcommittee's management evaluation and observed: "Decisions through an entire program—from design, thru the various stages of design, through development, through design, through further testing, through production and the assurance of quality production, through supply and protection of quality in the supply system—must be made by men who have to stand up and be counted." As the men who must answer to the combat soldier who takes that equipment into the battlefield with his life in his hands, we cannot have these decisions made by other persons for us. These decisions must be made by the best of our knowledge, reinforced by the knowledge of others in equal objective positions.

We must have technically competent people on the procurement payroll, who also have an understanding, and who therefore can afford to be objective, and to select the needs of everybody—people who cannot afford to be other than objective."

Air Force and Navy testified similarly, however, that the major portion of their funds are expended not in re-

duction. Medina and Army's Missile Command spends 35% for headquarter operations, 55% for unit management, including testing and range management, 5% for in-house research, engineer, acquisition and technical effort, and 49.75% with contractor organizations. Navy reported that 90% of the Polaris funds is invested in contracts with 140 prime contractors.

## Other Highlights

Other highlights included:

• Total cost of Army's ballistic missile test range development is \$122 million, compared with a total of \$570 million spent on similar projects by Air Force and Navy. Medina and the Army principle has been applied to Air Force and "should be used in this."

• During the development of the Army Jupiter and USAF Thor programs, Medina and USAF "respectively denied" Army requests for information and submitted information to Army "elsewhere" it had been a dead end." In one instance, Medina and Defense Materiel Division director, Gen. Elmer Nau, agreed that the USAF's policy of not releasing the Secretary of the Air Force. After obtaining a letter from Gen. Thomas D. White, Air Force Chief of Staff, authorizing the release, Medina and he was told by Maj. Gen. George S. Miller, USAF BMD commander, that he would have to receive the letter "through channels."

• Becker was optimistic that Army in the future will be permitted to develop missile heads and the 350-mm range limit set by former Secretary of Defense Charles E. Wilson, President Ford's companion in the issue, Becker noted, was set by the Martin Perkin's which will have a range in excess of the 350-mm range of its Soviet counterpart for tactical ground operations.

## News Digest

Kansas Aircraft Corp. has completed negotiations with the Navy Bureau of Aeronautics for a follow-on contract of 1012-1 helicopter.

• The company will total about \$14 million (AVN Feb. 23, p. 59). Another utility helicopter, USAF, Jan. 20, 1970, p. 78) will have emergency flotation bags that can be filled with air at 28C within two seconds.

Bathla decided on a corporate structure is expected to come soon. A special committee appointed two years ago to study the project has made an report to the Ministry of Supply. Minister Anthony Jones says he will decide soon whether or not the British aircraft industry should undertake such a project. Committee members would be from British Aerospace, de Havilland,

## Atomic Blasts Create Radiation Belts

Washington—First man-made radiation belts around the earth were produced last fall to a level induced by the explosion of extremely low-yield nuclear bombs of an altitude of about 100 miles, says Dr. John S. Foster, Air Force's atomic research director. A second test last week

of the experimental yield of Defense Department's advanced Research Reactor under the code name Project Argus, was to produce smaller knowledge and to explore its military importance for defense, missile defense, offense and military communications, according to Defense Department spokesman.

These low-yield atomic bombs, created after a three-stage modified Lockheed X-17 vehicle from the USAF Nuclear Board, were exploded on Aug. 27 and 30 and on Sept. 4. Both produced a plume of electrons which spiraled around and along the earth's lines of magnetic force. Within a short time, negative electrons of the electrons had produced a thin sheet of electrons circling completely around the earth similar to the natural Van Allen radiation belts which exist at higher altitudes.

Man-made radiation belt, which formed for short conducted several before dissipating as energy through particle collisions with the atmosphere, was probed by Jason research vehicles as well as Explorer IV orbited with Geiger and atomic fission monitors for measuring radiation intensity. Change in satellite level was measured to be detectable on the earth.

Data collected by Explorer IV, being part of U.S. participation in the International Geophysical Year, will be released by National Academy of Sciences in a forthcoming publication. Data obtained from sounding rockets and other sources will not greatly be affected by possible orbital interference, according to spokesman of Defense Department's reactor.

One possible military application would be to use low altitude atomic explosions during an intense missile attack to block out an enemy's high frequency radio which now forms the backbone of existing long-range military communications systems. Another is the possible creation of a thin electron sheet to shield ballistic missile nose cones from ground-based ballistic missile detection radars.

For the experiment it is believed of devices observed by Nathan Christensen of the University of California's Radiation Laboratory, as a result of his work on atomic thermonuclear warheads for investigating fusion power techniques.

Quarles and his team were to concentrate between Project Argus and the high-altitude thermonuclear explosions over Johnston Island in the Pacific which just provided these. Later in November, he planned a similar effort of boosted scope which was observed at an atomic bomb in France—a highly boosted atmosphere at atomic low altitude Johnston Island explosive apparently failed to spread around the earth because they took place at lower altitude where energy was more quickly dissipated.

Further scientific investigation of the phenomena were predicted by Defense officials, including additional high-altitude atomic explosions, when and if current U.S.-Soviet test-ban negotiations will permit.

• Headline Page, Elmer Suddeth, George, Bob Ritter, Steve Berthold and Bill Head, Workers Accounting, BOAC, and the Royal Aircraft Establishment.

• Thosil Chemical Corp.'s solid propellant propellant for the Nasa Zvezda series inside nozzle has attained thrusts of 450,000 lb per second of 45 sec. These figures are well above the 300,000 lb per second of 45 sec in state tests. Roger was incorrectly identified as a General Control Rocket Co. rocket (AVN Feb. 16, p. 29) and a typographical error colored its thrust from 450,000 to 45,000 lb.

• Royal Australian Air Force will evaluate a Hawker Aircraft Avon F4 engine, starting in May. Six months evaluation will cover all service conditions and possible use for pilot pressure housing on jet planes.

• West German government has officially signed an order for 96 Lockheed F-104 jet fighters, with delivery sched-

uled to start at the end of this year. Initial production will be 30 two-place trainers and 60 advanced multiplace variants which will be built at Lockheed Aircraft's Berlin and Potsdam, West Germany. Order extends to 1974 production rate.

• Verol Aircraft Corp.'s tilt-wing Model 76 has made 621 flights including 150-500 ft and 35 full combat entries from helicopter to low-level flying low-level flight and return to hover. Model 76 will be sent to National Aerospace and Space Administration Flight Center, Edwards AFB, Calif., in a few weeks for flight evaluation in cooperation with Army.

• American Airlines reports a 1975 air-traffic fair of \$16 million, including \$6,000,000 from the disposal of property. Recruit for the year reached a record \$177.1 million, an increase of 3.7% over 1973.

## Justice Department May Join ATA Probe

Airlines feel investigation will cause deep rift in relations with Board, inquiry aims unclear.

Washington—Unexpected Civil Aeronautics Board order calling for an inspection of the Air Transport Assn. (ATA) Mar. 16, p. 23) was issued last week by a request from the Justice Department which wants to conduct an investigation of its own.

In a letter to the Air Transport Assn., the Department of Justice said it sought access to the association's files for the purpose of conducting an antitrust investigation. The letter noted that the Board was now inspecting the association and suggested a "consensual" investigation would create an optimum of nonreciprocity to the ATA.

Meanwhile, Civil Aeronautics Board lost no time in launching an all-encompassing "inspection and review" of the ATA. Even before the order was presented to ATA, four Board staff members were on its doorstep offering blue to begin the probe.

Later were offered four photographs and at least one attempt to inspect the desk drawers of an ATA member was made. The probe, by the investigation of ATA President Stuart G. Tippins was thwarted.

Otherwise, the inquiry is accepting the order, quoth, and the Board has officially taken the position that the inspection is not a "Gatling" action but a natural procedural step taken to the probe inherent.

Following receipt of the Board order, Tippins announced publicly that the ATA will "keep things to a minimum" in the inspection and review. Both the members of the Board and ATA officials are now obviously anxious to play down the potential significance originally attached to the inspection.

Problems, however, are likely as not taking the order lightly had a number of staff carried over the Board action which was spokesman toward "flexible" and "lenient" in view of the finding of major faults the Board has taken. The order makes the 47 certificate holding members of the ATA, practice to the proceedings.

General feeling among the members is that the Board action will have at least one inevitable effect: it will create an even deeper breach—if not an irreconcilable split—between the CAB and the industry which the CAB is trying to regulate. Several of the industry spokesman contacted by Aviation Week are poised to put what the Board expects to accomplish by the inspection.

Spokesmen for the Board have not been willing to elaborate on that point

but by standing between the lines of the order, agree that it is tight-writing, carefully worded and without any loopholes that would force the Board to sacrifice the almost hallowed scope of investigation the airline guards. The order is backed by the unanimous support of the five Board members.

In this connection, however, several representatives of the Board agree that the order may not be as far as it is in the language that could limit, but it is not in the language, the inspection and review can still pursue a "politic" action. A case in point is the use of word "phases" in the second line of the order which calls for an inspection of all records of ATA, and its members, including but not limited to claims, accounts and agendas.

It is not clear if a committee of "personnel independence" they are

at least one Board member said he deplores the quick manner with which staff members moved into the inspection because of the strong implications behind such an action.

Some industry members infer from the order that the probe will follow the inspection and review. The strength of ATA's activities in advancing as authority lies to the enforcement of the substance of the order—that is, a general inspection and review. "It's intended to determine whether the Board should can have its approval of the aggressions of ATA, and if so, whether the Board should impose further conditions to such action."

The order acknowledges that the ATA "played an active part in the congressional hearings which led to the passage of the Civil Aeronautics Act of 1938." However, it emphasizes that the association activities have grown to "increasing" and "detrimental" of antitrust and review.

The suggestion of "increasing" ramifications of the order and review is a basis for the conclusion on the part of some observers that the CAB probe may be a direct attack on the ATA.

However, the Board's order also places emphasis upon the end and costs of the review carries over to the ATA. In this connection, the Board states that it "has no knowledge of the specific ramifications by and intensities with each member under the formula" for proceeding over it.

The date is not as yet indicated to move the actual inspection of the review time. The formula is presumed upon the amount of review to be spent under

the association's budget, and the Board has no thought information concerning that budget.

The order also suggests the Board will probe to the influence the larger railroads carry in ATA affairs. It also notes that "ATA membership consists of 46 of certificate carriers, including the local union and cargo carriers, but says that the "core" of the association membership is composed of these railroads which formed the ATA in 1938.

Later the order has that to say on the influence of large airlines on the ATA.

Therefore, it is appropriate for the Board to determine to what extent, if any, the large concern control the actions of all carriers through the instrumentalities of the ATA.

The order contains a show cause clause which penalty imposes action objecting to a final Board order for the inspection to file documents and order action supporting their objection with the Board by Mar. 30.

### Hughes Asks Approval Of TWA Lease Plan

Washington—Hughes Tool Co. has applied to the Civil Aeronautics Board to lease Boeing 707 and 720 jet aircraft for the jet aircraft to Trans World Air Lines. Hughes Tool holds the majority stock in TWA.

Specifically, Hughes has asked the Board to modify an acquisition and control order of 1944 to avoid any restrictions on planned transoceanic flights in the airline. The manufacturer and it has 14 Boeing 707-331s on order at a cost of \$4.7 million per aircraft and that while TWA has made no specific commitment to acquire these, transoceanic flights will be given priority to the jet aircraft to be made available.

First of the new jets has been re-

named by Hughes and delivered to TWA under a day-and-night lease arrangement approved by CAB last month. Hughes tool said the aircraft is expected to make 11 round Boeing jets to the airline under the same leasing arrangement at a cost of \$1,500 a day. The leasing agreement are expected to expire by June 30 of this year and are subject to termination by either party upon 24-hr. written notice, the manufacturer said.

Stock spare parts for the jets also have been acquired for use by TWA at Hughes' productive cost. The company said it will be responsible for the cost of aircraft with a limitation of \$1.5 million on the total value.

Hughes also said at place to deliver 10 spare engines to the airline under a lease arrangement similar to that on the aircraft.

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### CAB Opens Hearings on PanAm 707 Atlantic Dive; Crew Testifies

By Robert I. Stanfield

Editorial and news items so as to avoid crowding of the column.

• **Flight recorder.** Due to a shock lag aircraft recorder, lost, has been removed from the 707-123 left wheel well at Castle, prior to inspection by Federal Aviation Agency officials. King stated that the recorder, manufactured by Lockheed Aircraft Service and enclosed for 153 hr. of flight, had run out of tape prior to this flight. Capt. Sverre Mikkelsen, chief pilot of Pan Am's 707s, said the recorder was at Castle Division and the tape had run out Jan. 27.

Deposition will be taken April 1 at Boeing Airplane Co. headquarters at Seattle, Wash., at the company's Renton plant. More will be taken April 6 at Los Angeles during interviews with personnel of Lockheed Aircraft Service and Federal Aviation Agency.

Aircraft N7212PA was at 53,000 ft. when it left London, England, Nov. 16, 1958, and was at 32.5 deg. N., 40.5 deg. W. when the dive occurred at approximately 2200 Greenwich Mean Time. Mikkelsen, outside an transoceanic was 5000 ft., cruise speed was Mach 0.85; gross weight was between 190,195,000 lb. The 707 was parked out at 60,000 ft., following which it was flown normally and landed at Castle (AvW Feb. 9 p. 9).

Depositions taken by a four-man CAB panel headed by Vice R. O'Brien, Bureau of Safety, brought out the following:

• **Autopilot control.** Crew was not on time when aircraft was on its Boeing 707-123 autopilot just prior to the dive. No warning light, including a disconnect had been given. The disconnect during the dive was left alone. After 3 hr. operation of the autopilot was normal during ground check later made at Castle. Warning light was found in fuselage position several hours after aircraft was landed.

During two previous flights the autopilot had malfunctioned, causing a nose down pitch as one instance due to disconnect following an about 10-deg heading change in another. William King, Pan American engineering supervisor, stated that prior to this incident very less disconnects had been reported without the nose light being on.

Three days before this dive, the aircraft was flying during a flight of route 8000 ft. altitude, disconnect, with no warning light, was reported, prior to which the aircraft had about 40,000 ft. altitude and heading at 4,000 ft. It was necessary to make a sharp climb, suspended falling back to 1,500 ft. Wings level in altitude of 8,000 ft. and accelerated to 270 ft.

King noted that engine responded well, with low right rudder necessary to hold it straight. Operating the aircraft by hand, cut out switch was on.

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Smiley had previously pulled aircraft back to within 100 feet of the ground.

Flight descended to 200 ft AGL about 20 min out. At 18,000 ft it descended to 120 ft AGL, lowered flaps to 30 deg. Autopilot indicated 198 ft. Descended to 6,000 ft and lowered gear. West star threshold of 100 ft was high enough to prevent landing.

• Captain T. Peter Thompson chief pilot for Pan American's Pacific Division. At 2300Z, navigation panels change to landing, requesting left turn. Used autopilot two levels. Turn 0.5.

The light buffering, plus gusty load factor holding. Then held holding course past light to fail.

Captain's altitude hold had canceled.

Footage of fail and swoing then showed aircraft on its back.

Took over controls and tried to stop by using left ailerons and rudder, but load factor such as was experienced. Change in aircraft attitude. Lightened forces, static buffering continued. Various landing techniques. Lights were activated automatically. Then Capt. French came in for test.

French rolled out to cut power and for navigation to pull out attitude. French tried to interpret the roll. French said that the forward panel was 30 deg. to a Cheshire cat<sup>1</sup> during descent. Master read both of him during descent.

King stated that Pan Am's engineering section had records of on-trim never being removed from autopilot on the 707, but none of the records were associated with runway runs.

There had been some difficulty, he said, with Mach warning lights switch settings.

French later commented that the aircraft at Canada for checking with Capt. French's virtual gimbals, which reportedly had been checked, and which showed no inaccuracy. The controls showed no evidence of assembly in center control column (pitch pitot did not exist as it should). Autopilot turned itself off. PA-300 came from autopilot, normal because of reports that elevator and stabilizer trim had been seen moving plus extreme sensitivity of card.

Following the incident, King said, Pan American maintenance was requested to put non-functioning cockpit trim switches in the cockpit. This included pulling stabilizer power breakers and pulling autopilot control breakers.

Stabilizer deflection was full nose down, 5 deg. Stated to break it back to attitude position. Capt. French used stabilizer trim to correct some nose-down trim.

Found that center warning and trim control breaker had popped (see P panel). At Guarder ran a Mach test and stabilizer check OK.

Night inspection at Dallas shows about 30 in. of Elfit running from right wing, top tail, about center with damage less at the point on Elfit. This indicated considerable movement of wing at this point. Stabilizer showed some wrinkles.

Harold D. Maday, The American dispatcher doing the "jump test" in an observer, also noted that the panel

seem as normal). It has a unique feature for bank and pitch control, and a trim-stepper mode which will be operated independently from rest of autopilot.

Biggest difference between the PB-200 autopilot and the 700 and 800 is that the PB-200 has a 30 deg. roll authority, and is 70%+. The comparison is basically a second autopilot computer, comparing what happens in aircraft control surfaces and what they should be doing. Computer control used by autopilot for autopilot engagement.

Leggett explained that the computer would disengage the autopilot as soon as before the normal trim, and that it is incapable of automatically rolling into the roll. It is not considered mandatory for PB-200 operation. He stated that the autopilot warning light should operate independent of automatic pitch power sources that should power in the light fail, from an incorporated in the light bulb.

Leggett said that two limitations include 90 deg. freedom in roll when there are two at 30 deg. as pitch, but that is, auto holding "If power is removed from pitch, and it is subject to bank angle in excess of 30 deg., gear would fail—but power must be off at least 20 sec." Leggett pointed out.

If clutch power to aileron power to drive vertical gear is interrupted, Leggett said, it would maintain speed for operation for about 20 sec. In the case of Capt. French's gear banking, it was stated that possibly the power was off at the same time that an 80 deg. bank angle was achieved. (Power to vertical gear is one of conditions for engagement of autopilot, but not for disengagement.)

#### Rate Switch

It was stated that the rate switch was definitely cooperative as the 707 rolled again. "It goes departed from initial inputs with computer inputs or engaged, monitor would disengage autopilot. If it departed slow, monitor would become disengaged before monitor to change pitch attitude was introduced to the autopilot." This is assuming the altitude integrator was engaged.

Engagement of the rate, measured from the autopilot computer status log made by Elfit, Inc., of Fort Washington, N.Y. Elfit's chief engineer, Lewis DeSlo, stated that a check indicated the relay contact pressures were "slightly less." Check of discrete voltage showed three switches dropped out at 1.5 sec. remainder at 2.5 sec. Encoder contacts showed lighter than normal contact resistance. He said and He thought the relay may have been dropped, then subjected to high shock level.

## Transcontinental Case

Washington-Puerto Rico flight for the Southern Transcontinental Service Case is ending completion with the submission of flight exhibits and proposed schedule from the 18 month case.

Captain Associates Board has at this time the first of two reports. The first was May 20 in Los Angeles and June 15 in Miami. Board convened for the Board and airline representatives to deliberate to present flight evidence to examine Edward T. Stadler, a Washington state attorney.

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## Electra's Approach 'Normal' Until Crash

New York—Everything in the cockpit of American Airlines Lockheed Electra N4101A, indicated a normal approach, with the aircraft heading about 290 ft, when it entered into New York's East River during final approach to LaGuardia Airport last Feb. 1, according to testimony of Capt. Frank S. Hirsch, who flew as first officer aboard Flight 5201 during the Civil Aeronautics Board accident investigation hearing which opened last week.

Flight 5201, enroute from Chicago, was making a standard instrument landing, an automatic pilot, on the back course ILS, low-level stage, facilities to LaGuardia's Runway 22. There were 66 passengers and a crew of five flight, first, navigator, and three crew members (Hirsch), flight engineer Warren E. Cook and stewardess (M. Zelkin) survived. The captain, William M. Albert H. DeWitt, died in the crash (PA 498 Feb. 12, 1971).

American has since amended its approach manual, requiring that automatic pilot be used in automatic position for initial approach or not be used at all and cannot be flown visually.

• **Flight 5201.** Flight was an instrument approach, most of the trip. Considerable time was consumed during initial portion of descent from 21,000 ft to cruise altitude. Light flight accumulated on washboard ridge, which delayed after clearing. Elfit stated the flight was on instruments until they lost water, and he recalled seeing some red lights. "For us—out the side window, below cockpit level, immediately before the crash."

At the time of the accident, approximately 2155 EST, wind was from the southwest at 5 mph, character fitting sea 29.77 in. ceiling was 400 ft, and visibility was 2 mi. in light and fog. Successful back course approaches were made by other aircraft using the same facilities that night with the exception of one missed approach by a Northwest Airlines' Viscount and a corporation DC-8.

#### Initial Findings

Initial testimony before an eight man board of inquiry, of which G. Joseph Mazzoni is chairman, Robert W. Chipp is hearing officer and Franklin M. Shoup is legal advisor, pointed up the following:

##### • **Altitude readings.** Flying over LaGuardia stage on final approach to Runway 22, both DeWitt's and Hirsch's altimeters read 980 ft, with the aircraft slightly to the left of centerline. Elfit's altitude indicator altitude reading does not exceed 100 ft. Cockpit lighting during descent was comfortable, and altitude was read less than 500 ft during the approach. He also said the Kalkhoff drama type altimeters was functioning normally during all phases of flight prior to the crash, indicating corrected readings over range. De-

Witt read 4,500 ft short of Runway 22, 610 ft to the right of the centerline. • **Automatic pilot.** In normal operation during descent from Chicago, the Electra PB-200 automatic pilot was a bit rough on turns according to Hirsch. Prior fully automatic operation it was necessary to trim the heading mode for remainder of turn.

Flight 5201, enroute from Chicago, was making a standard instrument landing, an automatic pilot, on the back course ILS, low-level stage, facilities to LaGuardia's Runway 22. There were 66 passengers and a crew of five flight, first, navigator, and three crew members (Hirsch), flight engineer Warren E. Cook and stewardess (M. Zelkin) survived. The captain, William M. Albert H. DeWitt, died in the crash (PA 498 Feb. 12, 1971).

• **Flight 5201.** Flight was an instrument approach, most of the trip. Considerable time was consumed during initial portion of descent from 21,000 ft to cruise altitude. Light flight accumulated on washboard ridge, which delayed after clearing. Elfit stated the flight was on instruments until they lost water, and he recalled seeing some red lights. "For us—out the side window, below cockpit level, immediately before the crash."

At the time of the accident, approximately 2155 EST, wind was from the southwest at 5 mph, character fitting sea 29.77 in. ceiling was 400 ft, and visibility was 2 mi. in light and fog. Successful back course approaches were made by other aircraft using the same facilities that night with the exception of one missed approach by a Northwest Airlines' Viscount and a corporation DC-8.

• **Crew experience.** During his Electra training at Ft. Worth, Tex., Capt. DeWitt had a total of about 25,000 hr. After 8,000 hr in Electra flight he had, for one year, been flying with a Federal Aviation Agency inspector, who checked his instruments for instrument approach procedures and ILS approaches with captain on out. The following day, Dec. 16, 1970, he joined his crew. A record of American training records showed no evidence of his failure on Dec. 15.

At 45.13 total hr in the Electra flight no accident history, American Airlines' record of crew experience showed that Capt. DeWitt had 14,000 hr in the Electra flight and altimeters were cross-checked. Set was 14.77 in. Altimeters were cross-checked again when passing the stage indicated at 900 ft.

Flight 5201 had departed Chicago's Midway Airport at 2155, at a gross weight of 194,545 lb. The Electra flight had been flying for 1 hr 42 min when the speed of 256 to 340 mph and ground speed of 196 to 300 ft. Reserve fuel was estimated at 4,500 lb.

• **Flight 5201.** Flight was an instrument approach, most of the trip. Considerable time was consumed during initial portion of descent from Chicago, the Electra PB-200 automatic pilot was a bit rough on turns according to Hirsch. Prior fully automatic operation it was necessary to trim the heading mode for remainder of turn.

TOP: FROM LEFT: SOUTHERN LUFTHAUS, MELBOURNE, VICKERS VANGUARD, MIDDLE: BOAC 747, BOAC 747-200, BOTTOM: CONVAIR 990, BEECHCRAFT BARON, CONVAIR 880, BEECHCRAFT BARON, BOAC AIRPORT CARAVELLE.



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## CAB Defers Action on Bid By BOAC for Tokyo Route

Washington—Civil Aeronautics Board last week dropped its sharp worded language in a petition by Air Transport Association to withdraw in the controversial British Overseas Airways application to add Tokyo to its around-the-world route.

At the same time, the Board deferred that portion of BOAC's petition asking authority to carry international traffic between two points within the U.S. The Board and the petition of the petition would be deferred pending a decision on a similar application by Quantair Europe Airways (UW May 18, p. 38).

Northwest Airlines is more the sole relativator in the case in which BOAC is asking for authority to begin around-the-world service via New York, San Francisco and Tokyo on April 1. Northwest, in the forthcoming conference, moved that the Tokyo stop be removed from the case pending a clarification of the bilateral agreement between the U.S. and Britain.

Board's denial of ATA's petition to intervene in the second case is that case that the association lost a bid to participate in the proceeding. In denying the second petition, the Board said that the case can be fully litigated by BOAC, Northwest and various counsel and that ATA participation "will likely tend to complicate and delay" the case.

As matters now stand, the Board must rule on three motions before last day can be held. These are the motion by Northwest to sever the Tokyo stop

from the case. The motion by BOAC against for a ruling on Section 1302 of the Federal Aviation Act and a motion by Northwest to defer a motion to withdraw from the controversial British Overseas Airways application to add Tokyo to its around-the-world route.

Here are the main Northwest motions:

- Interpretation of intent and meaning of paragraph 4b of the Bermuda agreement. Northwest is contending that paragraph 4b permits the addition of "points of limited significance" to existing routes and, in Tokyo, in one of the world's longest routes, does not fall within this category.

- Determination as to whether the bilateral air service granted authority to serve Tokyo in intergovernmental agreements supplemental to the Bermuda agreement. Such agreements are to be reached by consultation between governments involved in the exchange of routes.

On the Tokyo stop, Northwest is relying on a letter dated Jan. 22, 1957, from the Civil Air Attaché at the British Embassy here to the Department of State, and a reply from a "representative" of the State Department that section 4b does not constitute an analog to route. According to the Northwest

motion, BOAC relied upon these letters as "an alleged operation evidence in an exchange of letters."

Northwest noted that the letter does not a British intention to add Tokyo to the routes in question but says that the letter "proceeds in its second paragraph to dismiss itself." In effect, the carrier is claiming that the letter contradicts the Northwest position of paragraph 4b that it is not.

In doing the holding Tokyo to BOAC's motion, I would like to note at this point that we are not in any way departing from our previously expressed view that 4b provides an inappropriate basis for the addition of other than minor routes.

Left wordless, the Civil Aeronautics Board asked the State Department for an opinion on the BOAC request for a Tokyo stop and, on Feb. 27, received a letter which contained this passage:

"Had the Department of State not declined earlier that the addition of Tokyo was not a legitimate exercise of a nation's 4b right or that improper procedures had been followed, it could have requested reconsideration on the diplomatic basis, if the question were not that the substantially involved would not be an infringement under Article 9 of the Air Transport Services Agreement. However, the Department of State of the time of confirmation was of the opinion section 4b was being properly construed in this particular instance."



Ansett-ANA Electra Makes First Flight

First flight of initial Lockheed Electra turboprop aircraft for Ansett-ANA, Australian airline, is made at Rockbank, Calif. Interim configuration is for 68 feet plus passengers in four classes using aircon system. Aircraft will be based in Melbourne, Australia.



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## Airline Traffic—January, 1959

	Revenue Passengers	Revenue Passenger Miles (Mile)	Load Factor %	U. S. Mail	Freight	Right	Fare	Revenue To Available Seats-Mile
<b>DOMESTIC TRAFFIC</b>								
American	368,379	33,834	87.9	1,142,384	845,005	8,354,703	24,000,204	33.8
Delta	119,119	7,014	87.8	215,744	15,209	15,209	24,000,000	33.7
Capital	123,428	10,419	90.0	612,317	322,870	329,479	14,330,559	23.1
Continental	70,415	46,331	87.1	104,412	42,373	511,408	6,743,468	33.2
Delta	201,208	15,163	89.9	409,781	187,434	1,344,700	16,943,179	34.1
Eastern	279,792	21,849	88.9	449,449	10,200	1,200	24,000,000	43.7
Midwest	161,441	117,203	87.8	200,442	15,328	412,722	12,499,328	33.2
Northwest	63,411	47,307	87.8	90,141	16,000	16,000	6,767,000	33.1
Northwest	126,459	119,361	84.9	102,556	358,958	1,144,371	12,000,000	44.5
Trans World	120,375	125,275	87.9	1,242,442	10,200	10,200	24,000,000	44.5
United	561,376	437,772	87.9	3,879,311	7,056,741	8,384,275	11,376,400	33.8
Western	119,207	64,393	88.4	197,314	72,334	338,368	7,000,000	43.5
<b>INTERNATIONAL</b>								
Aeroflot	3,480	8,394	86.9	7,016	137	137,708	800,000	37.8
Brussels	5,423	6,001	81.7	18,019	104,410	104,410	900,000	39.7
Caribbean Islands	29,049	1,811	83.2	1,012	4,480	4,480	200,000	33.2
China	1,000	1,000	87.0	4,000	4,000	4,000	200,000	33.2
Emirates	26,812	19,704	85.12	63,957	161,000	8,334,460	44.31	
Malta**	6,423	6,236	86.1	6,236	2,070	24,000	200,000	33.8
Malta**	15,716	25,307	86.9	1,187,410	19,164	1,187,410	1,187,410	33.4
Pan American	3,473	2,616	84.2	26,942	173,382	173,382	400,000	32.1
Africa	24,197	192,360	86.9	1,506,585	2,317,412	14,400,000	12,400,000	33.4
Africa	12,110	122,223	86.9	1,121,410	2,415,410	18,400,000	12,400,000	33.4
Pacific	20,263	95,274	75.2	1,372,410	1,761,743	12,353,400	18.9	
Panair	15,311	11,710	83.6	47,487	612,267	1,171,336	30.0	
Peru**	1,000	1,000	86.0	1,000	1,000	1,000	200,000	33.8
East Pakistan**	10,351	30,307	85.6	700,000	1,823,128	18,312,359	44.4	
ENAC	205	67	86.3	67	452	2,452	400,000	37.8
United	7,243	11,428	87.8	120,011	47,410	9,000,000	12,400,000	33.7
United	5,340	6,118	76.1	6,118	23,911	9,000,000	70.2	
<b>LOCAL SERVICE</b>								
Allied	50,341	2,700	80.3	15,381	76,450	76,450	900,000	43.4
Boeing	1,443	1,443	86.9	4,000	2,244	2,244	200,000	37.7
Central	12,176	3,472	85.2	6,625	3,208	3,208	200,000	37.4
Freder	18,200	1,048	86.8	19,000	1,179	49,484	900,000	33.8
State Central**	41,780	8,240	86.8	11,244	11,722	11,722	200,000	33.8
South Central	28,702	7,720	86.4	95,001	31,959	31,959	1,100,000	37.1
South	10,243	6,126	86.4	9,701	10,000	10,000	600,000	33.8
Pacific	90,430	6,071	86.4	11,129	4,210	4,210	900,000	33.8
Alaska	23,727	2,727	86.4	12,700	12,118	12,118	372,000	33.8
Alaska	11,112	3,200	87.9	9,493	16,959	11,118	372,000	33.7
Trans-Island	17,367	2,008	86.7	15,009	10,000	10,000	35,000	33.8
West Coast	12,551	4,457	86.91	5,037	2,220	2,220	300,000	33.8
<b>MANUFACTURERS</b>								
Boeing	10,473	4,700	87.8	4,107	184,171	184,171	400,000	37.8
Airbus	13,331	1,726	83.1	700	2,710	1,401,311	1,401,311	33.8
<b>CARGO LINERS</b>								
American	—	—	—	—	9,733	14,729	9,000,000	40.3
American and American**	1,204	4,155	100.0	46,870	27,621	10,244,058	11,304,480	91.0
Trans-Island	—	—	—	—	—	—	—	—
United	147	672	100.0	41,741	—	3,169,376	2,764,418	38.8
United	2,013	20,391	93.22	—	—	—	6,301,444	10.71
<b>MICROFIGHTERS</b>								
Chicago Midway	8,810	100	89.9	800	4,204	193,703	10,712	36.8
Los Angeles Airways	1,481	72	86.4	5,487	1,202	1,202	10,712	36.8
New York Airways	8,810	142	86.4	7,017	1,224	1,224	14,400	33.8
<b>ALASKA AIRLINES</b>								
Alaska Airlines	3,354	8,072	86.1	12,201	4,204	193,703	10,712	36.8
Alaska General	3,274	2,050	86.2	2,956	4,102	2,956	20,300	36.8
Centex	691	138	86.2	2,311	4,102	4,102	48,912	36.8
Elli	3,834	158	86.7	1,422	1,202	1,202	10,712	36.8
Northwest Consolidated	3,341	429	86.4	1,011	2,000	2,000	10,712	36.8
Pacific Alaska	4,024	4,024	86.4	12,041	4,204	193,703	10,712	36.8
Alaska Airlines	851	574	86.2	20,428	84,316	84,316	100,000	36.8
West Alaska	2,621	278	86.8	10,330	232,711	232,711	200,000	36.8

\* Not available.  
Compiled by American Week from data reported to the Civil Aviation Board.

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## SHORTLINES

► **Air France** reports 2,517,371 passengers flown 2,164,210,000 passenger miles during 1958, a 20% passenger-mile increase over 1957. Also during 1958, 19,184 short tons of mail were carried, a 7% increase over 1957. Air France and British Overseas Airways have entered into an agreement by which passengers may use airline lounge facilities in order to travel on the other of the carrier's schedule in more convenient

► **Braniff Airways** has signed contracts with five major U.S. oil companies to supply the carrier with more than 340 million gal. of jet fuel for its fleet of Lockheed Electra and Boeing 707s. Companies are The Texaco Co., Esso Standard Oil Co., Phillips Petroleum Co., Humble Oil Co. and Continental Oil Co.

► **Civil Aeronautics Board** has announced the foreign air carrier permit issued to Cuban carriers, American "DC" S. A., to include Fort Lauderdale, Fla., as a terminal point with West Palm Beach as the carrier's flight base. Havana

► **Flying Tiger Line** reports to Civil Aeronautics Board the carrier to be the nation's largest air freight carrier with 104,371,482 freight ton miles flown in 1958.

► **Kinter Transportation Co., S. A.**, has been authorized by the Civil Aeronautics Board to hold a temporary foreign air carrier permit to transport passengers from Miami to a point, or points, in Cuba. Duration of permit is six years.

► **Lockheed Aircraft Corp.** is scheduled to deliver 312 Electra turboprop aircraft valued at more than \$30 million during 1959, according to an announcement by Lockheed board chairman Robert E. Gross.

► **Quaker Air Lines** will maintain its operations from 17,000 ft per day on May 1 to 25,000 ft per day, with the inauguration of five new routes and extension to five routes previously served as authorized by the Civil Aeronautics Board in the State Air Code.

► **Trans World Airlines** will begin the first Chicago-London nonstop service on June 5 using Lockheed 1049 Constellation equipment. The airline also announced it will assume Chicago-Panama nonstop service on May 2 with a weekly service. The airline also will operate a weekly flight from O'Hare Field, Chicago, to Beirut, Lebanon, Paris, Milan, Rome and Athens.

## AIRLINE OBSERVER

► Domestic airline business took a sharp dip in February when enroute passenger miles rose 11.4% from the previous December total to record with a 9.8% decline in January and a 12.4% drop in December. Although total enroute miles increased 1% in February as compared with the same month of last year, load factor for the domestic airline industry showed a 16% drop from 50% in February, 1958. The eight airline carriers with monthly load factor increases recorded in the past four years

► **Shick Airways** is talking acquisition possibilities with several companies, none of which are carriers. The cargo airline, which last year was awarded authority by the Civil Aeronautics Board to suspend its operating certificate to cargo only (ACW June 30, p. 29), is looking for a merger that would be an acquisition rather than a sellout. If a merger is completed, Shick can carry forward large losses for tax purposes.

► At least one major airline will permit its pilots to decide initially whether a share of domestic cargo will operate by freight transport. Plans for the year in the referred case, complement of a month-long negotiation period after which a preliminary agreement on the issue will be negotiated between the company and the pilots.

► **El Al Israel Airlines** may be forced by the Israeli government to abandon its transatlantic routes and swap planes to develop routes in Asia and South America. Loss of traffic to the carrier because of an Arab transport boycott in the Near East and a deadlock with Britain over the question of extending service beyond London to the U.S. is causing the government to consider modifying the carrier's operations to European routes only.

► **Cav�inair** Air Lines is filing a bid similar to Western Air Lines' request for a route from San Francisco and Los Angeles to Honolulu and Hilo. In its application to the Civil Aeronautics Board for the route, Western and it would operate the route with Lockheed Electra turboprop transport. Continental would use Boeing 707-120s at ultra 707-120Bs.

► **Aloha Airlines** plans to begin operating three Lockheed F-104 turboprop transports in its interisland routes in June. The routes will help close the competitive gap created when Hawaiian Airlines booked its Douglas DC-8-Viewmaster routes with Conair 104s as competition against Aloha's fleet of DC-8s. Aloha purchased the three planes with government-guaranteed loans underwritten by Continental Assurance and United States Life Insurance companies.

► **Russia's** 100-passenger Tu 114 subsonic transport, which canceled from public view without any explanation almost a year ago, is back again — or paper, at least. Due of a series of five air postage stamp depicting modern Soviet nuclear transports featuring the Tu-114. Other stamps show the Tu-14, Tu-104, Tu-114 and the Tu-15. It seems unlikely that the 60-kilopound Tu 110 stamp would be issued if the Tu 114 were not destined to appear on the Russian civil aviation series.

► **U.S.** delegation to Rio de Janeiro conference on law structure on South American routes, headed by Civil Aeronautics Board Vice Chairman Clark Gandy (see p. 48), has decided to stand on ground of existing international agreements. The delegation will hold their own conference to discuss the new instruments for establishing and maintaining, subject to government approval, the highly complex structure of international laws and rules as a means of maintaining the use of intergovernmental processes in this connection.

► **Charles Vought** has contracted with Convair to build 120 compartments seats for the Convair 880 turboprop transport. The order is Charles Vought's first commercial airline in business since it began producing aircraft in 1947.

► **Pan American World Airways**' Boeing 707-130 turboprop transport operations has brought about a 47% increase in transatlantic travel during the first nine weeks of this year as compared with the same period of last year. All other scheduled transatlantic carriers showed an 11% increase in European travel during the same period.



NO MONDAY

MORNING

QUARTERBACK

\*\*\*\*\*

Good equipment, like a good quarterback, calls the right signals during the game and set on Monday morning. In the field of aviation and space, management must also call the right signals now for a game that won't be played for years to come. Al Grunman, the signals have already been called for nuclear propulsion systems, for the plasma heating of hydrogen fusion, for missiles, for hypersonic aircraft, and for others still classified.

Al Grunman, the signals that were called years ago have won design competitions: the A2F, a carrier-based attack fighter; the Sabre, a twin-turbine fighter; higher performance observation aircraft for the Army; and the Eagle, an air-to-air and air-to-ground missile.

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IRISH AIR LINES An announced plan is for three Boeing 720s. Orders are not firm.

## Irish Air Lines Planning Nonstop Transatlantic Flights for 720s

New York-Irish Air Lines plans to get transatlantic nonstop passengers from the intermediate-stage Boeing 720, the carrier's announced choice of jet equipment. Management will modify the 720 to increase its gross weight for the first foreign customer.

The airline, which began transatlantic service last April with Island Seaboard and Western Lockheed Super G Constellations (AWW May 5, p. 47), has placed a firm order for the 720 but has announced plans to buy three. The 720s have not been completed.

Value of the first program is \$44.5 million, including \$12 million for the aircraft and the rest for spares and equipment. American Airlines has ordered 25 of the 720s and United Air Lines has ordered 11. The American carrier, 720s will serve shorter routes and maximum gross of their passengers will be 180,000 lb, Irling says. First Irish Air Lines 720s with maximum capacity of 11,000 to 13,000 passengers, will be able to operate at a 217,000 lb takeoff maximum.

With headed-up landing gear and more powerful engines, gross weight of this version of the 720 will go up to 221,000 lb. The Boeing 720, Irling says, will be 10 percent faster than the initial units, will be available in 1962, according to the airline.

Delivery date was one factor in selecting the 720, general manager Jim Nash, F. Denegre told Aviation Week. Irish Air Lines expects to get its first 720 in November, 1961, with the other two arriving in February and March, 1961. The lease with Island Seaboard and Western runs through 1965. Seaboard has itself Civil Aviation

Board for permission to buy up to 350 of the first airline's stock, but the move is still before the Board.

Denegre, who studies load comment, has that the 720 could fly nonstop in both directions in New York-Skikna nonstop. The jets will be operated in mixed service, yielding 160 seats and 20 first class seats.

The airplane also could be used on other Irish Air Lines routes to Europe, according to Denegre. The carrier has been flying Vickers Viscounts and Boeing 707s. Vickers aircraft added Federal 727 Friendship transports to its fleet. With delivery of the 720s, the fleet would be all-Boeing.

Irish Air Lines has traffic rights at Chicago, but no plans for expansion of its U.S. service in the immediate future, Denegre said. He expects services across New York and Boston. Boston service will be expanded with routes to Copenhagen next month and to Lisbon in June, according to Denegre and said these plans will be "launched" in considerably.

The 720 will have a lower price for the larger 201,120 seat Boeing 747 Air France. For American, "World Air" was. Price of the 720 is about \$55 and less. American Airlines uses a 720 not about \$51. million without options and, considering the cost of engines for the plane at \$10.5 million each, American, however, is buying the engines.

Boeing's W. Jerome Kast, manager of engine sales, transport division, told Aviation Week his company, based in Seattle, will the 720 in current operating South Africa service such as the 2,410 mi nonstop route between Dakar and Rio de Janeiro. New York distance is about 2,700 mi on.



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## MISSILE ENGINEERING

### Pershing to Test Industry's Missile Role

By Everett Clark

Plantersville, Ala.—Army-National Pershing 300/700-mi. missile is the first large ballistic system for which Army has contract a major part of development to a contractor.

The approach differs from that used by the Redstone and Jupiter contractors. Army, however, wanted to give all the development problems to contractors before awarding the purchased cost. The difference, however, is only one of the gear and not of principle according to the Army's Defense Materiel Command.

#### Enlarged Role

Nevertheless, the solid-propellant Pershing marks the beginning of an enlarged role for industry in the creation of large Army missile systems. Pershing represents a middle ground between the Nike family-developed almost entirely out of house, for the Army, by aerospace and the Redstone and Jupiter, which Army considers to be about as much as defense development.

For this reason, the missile community does not look on Pershing as a medical departure from its accustomed test approach to weapon system design, cost, and, rather as a continuation of the practice used to bring the early ballistic missiles into being.

Some reason why Redstone and to a lesser degree, Jupiter, were chosen to go into their life cycle in Army laboratories was a conviction in the Army that it had more experience for this type of work than it could find in industry in the early days of missiles.

#### Development Cycle

First induction within the Department of the Army that missiles would become a principal weapon in the Army came around 1949. In 1950 and 1951, Army says it had a difficult time finding contractors which it could succeed both capable and interested. The shorter range Corporal would be only way and development of the missile market Little John was just beginning.

But the group with the greatest knowledge in ballistic missile development at that time was the National Guidance Committee and engineers who came to the country from Peenemuende, home of the V-2 rocket, of the end of World War II.

Within two or three years, the pe-

ople with respect to industry had to be convinced particularly so he as to interest in missile contracting was concerned. But, by then, the Germans had been brought to Redstone Arsenal and work was under way because the Redstone people were well along.

The Germans team discontinued its capability of taking a missile through all stages from concept to prototype production. Along with the ability to do that complete or the missile program through various stages, went the fact that the Germans had the ability to develop explosives, which is useful all the administrative, legal and financial problems of dealing with contractors.

By the time Jupiter development was under way, industry had won the

#### PERSHING MISSILE DEVELOPMENT GOVERNMENT-CONTRACTOR STRUCTURE

DEVELOPMENT RESPONSIBILITY	MANUFACTURER	PRODUCTION RESPONSIBILITY	U.S. GOVERNMENT FACILITIES	OPERATOR ARMED FORCES
PRODUCTION RESPONSIBILITY	RTNS	ARMED	RTNS	PRODUCTION ARMED FORCES
PRODUCTION TEST RESPONSIBILITY	RTNS	ARMED	RTNS	PRODUCTION ARMED FORCES
PRODUCTION TEST QUALITY CONTROL	RTNS	ARMED	RTNS	PRODUCTION ARMED FORCES
U.S. GOVERNMENT MANUFACTURERS EXCEPT	RTNS	ARMED	RTNS	PRODUCTION ARMED FORCES

#### PERSHING SYSTEM SUPPORT EQUIPMENT DEVELOPMENT GOVERNMENT-CONTRACTOR STRUCTURE

DEVELOPMENT RESPONSIBILITY	MANUFACTURER	PRODUCTION RESPONSIBILITY	U.S. GOVERNMENT FACILITIES	OPERATOR ARMED FORCES
TEST OR MANUFACTURER	ARMED	ARMED	TEST OR MANUFACTURER	TEST OR MANUFACTURER
MANUFACTURER TEST RESPONSIBILITY	ARMED	ARMED	TEST OR MANUFACTURER	TEST OR MANUFACTURER
DIRECTOR TEST SET	RTNS PRODUCTION TEST	ARMED TEST QUALITY CONTROL	RTNS	TEST MANUFACTURER
U.S. GOVERNMENT MANUFACTURERS EXCEPT	RTNS PRODUCTION TEST	ARMED TEST QUALITY CONTROL	RTNS	TEST MANUFACTURER

Army felt not sufficient capability, but Jupiter presented a new problem of top priority—cost development. Time was an important factor in the decision to develop Jupiter within the Army even though Chrysler was given a larger part in development than it had with Redstone.

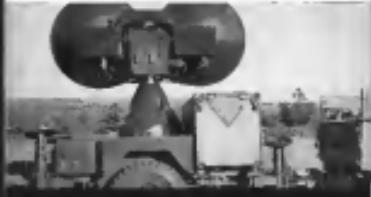
#### Industry-Army Future

The future relationship between contractors and Army's Ballistic Missile Agency, which oversees development of large missiles for the command, will depend on the success of the Pershing.

- How well the Army-Martin relationship works out on the Pershing missile.
- When Martin's Orlando, Fla., division was chosen as prime contractor on the Pershing.

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... Bendix Radar Antenna Pedestals specified for "Hawk" missile system



To locate, track and destroy low-flying, high-speed attacking aircraft is the mission of the Army's "Hawk" missile system now in production by Raytheon Manufacturing Company, the prime contractor. Speed, accuracy and dependability are mandatory.

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urbed that as something of a test run, indicating that there had been no firm decision, all future bidding would be done outside of AFMMA's jurisdiction.

• **Workload.** Within AFMMA at the time, one new missile system is assigned. AFMMA will still heavily involve with Jupiter and Blackstone work when Pershing was ordered and already had been given responsibility for several smaller and minor projects.

• **Whether Army is able to retain the top Blackstone man.** These men still are the nucleus of Army missile research and development. They also have been given a number of space assignments by Defense Department's Advanced Research Projects Agency and the National Aeronautics and Space Administration. NASA has a liaison with Army, but even when it attempted to have one Blackstone man transferred under NASA's space transportation contract, the Army would not readily go space vehicles, but the space agency said clearly as chairman of the joint space panel, probably toward the end of this year. Army also intends to stand its ground, arguing that the great majority of the team's time and effort are spent on missiles, and that Army must retain its capability to supervise and accomplish work by contractors.

### Pershing Concept

Concept and basic design criteria for the Pershing were developed in AFMMA's Development Operations Division, which is headed by Col. James H. Johnson, the head of engineers. Army long has had a desire to establish the design teams for a system, and to select a contractor to perform to those teams under close technical supervision.

Marine is prime contractor for the missile itself and for the system, but Army considers itself the equivalent of a "systems manager." In one armaments and control it has even assumed detailed design responsibility because of its preference for the system designed by its own laboratories, which is an extension of the work it developed for Blackstone and Jupiter.

Marine's function will be research, development, reliability testing, production, maintenance, reconditioning and field service. Since Army considers Pershing as an outgrowth of the liquid-fueled Blackstone and since it already has done most of the initial design, it considers the Pershing to be fairly well through what would ordinarily be called its research stage.

In selecting a contractor, however, it looked for one with sufficient research and development capability as well as experience in missile production.

Army initially developed a list of 125 possible contractors for the Pershing

system. It then narrowed this, again initially, eliminating 41 but now, this was up to 80. It now has a detailed set of criteria and about three weeks in should be developing proposals. At the end of this time, only half of the teams will receive two hours in which to make formal presentations. Then a procurement advisory board, consisting of representatives of technical, legal, fiscal, industrial, training, field support and other elements, narrowed the teams down to Marine. In the preliminary competition, the choice was unanimous.

The contract is written to cover three general responsibility areas:

- **Army** is which Marine and its subcontractors primarily responsible to AFMMA and AFSC. An example would be guidance and control where Army supervision is very close.

- **Marine** is which Marine and its subcontractors respond primarily to their own wishes as long as they are in line with AFMMA criteria. An example would be the missile structure where Marine is expected to move out on its own with a maximum of monthly reports and report bids to AFMMA. Another example is proposed, where AFMMA expects Marine to come up with a suitable approach through its propulsion subcontractor.

AFMMA believes that this relationship gives both the Army and the contractor maximum flexibility and still protects the government's interests.

Marine has placed an operational date on the Pershing system. A first stage engine was fired for the first time late last November. The system will

be strategically and technically air transportable and will be all tracking-type vehicles. It is a medium range missile as described in a "defining" usage weapon. One name suggested but not yet adopted for the system is "SCRAM," for "selective combat range missile."

Army and others at AFMMA, the Pershing contract line in Fiscal 1975 that it had \$30 million on hand for the program. Fiscal 1979 funding for Pershing is \$100.2 million.

A general breakdown of contractors and areas of responsibility for Pershing are shown on p. 57.

• **Propulsion.** AFMMA has retained supervision and Marine has responsibility for the propellant, propellants and the Thiokol-Chemical Corp. during the designing and the research and development of the mechanism of the propellant. RRD manufacturing of the most parts of the propulsion system is handled by other subcontractors.

• **Structures and assemblies.** including the airframe. AFMMA has technical supervision and Marine carries through with engineering design responsibility, the design work, tool and research and development subcontracting. Marine also does final assembly of RRD missiles.

• **Guidance and control.** AFMMA holds both technical supervision and engineering design responsibility. The engineering design support is done by AFMMA, Marine and the Eclipse-Pioneer Division of Bendix Aviation Corp. Marine and Bendix handle RRD subcontractors.

• **Windshield adoption kit.** Army's Pershing

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### Nike Zeus Components Tested

Vinson engine and engine components of Army's Nike Zeus intermediate missile are tested at Douglas Aircraft Co.'s Sacramento facility. Shown disassembled is solid propellant engine and fuel tank. Nike Zeus system is still under development (AW Mar. 9, p. 121).

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# AERONAUTICAL ENGINEERING



FIRST FLIGHT photo of the prototype BB-152 shows bicycle landing gear with a two-wheel bogie forward and a two-wheel bogie aft.

## East Germans Plan BB-152 Export Drive

LUDWIG-EAST Germany is beginning a strong commercial drive to produce and export its Bautz BB-152 four-turbo jet transport although one of two prototypes is reported to have crashed at Dresden. Mr. 4.

Plans are in production, with an initial schedule for delivery in 1960 and 15 by 1962.

East German authorities were silent last week about the crash at Dresden and there was no official confirmation that the aircraft was the BB-152 as is widely believed here.

Peter Bräuer, Bräuer, designer of the aircraft, would say nothing other than that the craft "was not caused by any technical defects." He said the recovery rate

surrounding the accident would come "in a few days" after investigation.

Two prototypes of the BB-152 have already been built, it was learned, and first flight was made in December of last year. The test model had an undetectably biplane landing gear with wingtip strakeless wheels but this design has now been changed to a tricycle arrangement with side wheels housed in the base of the four engine pods (AVW News 76, p. 45).

Details of the VEB Kombinat, ministry for the Flugzeugindustrie (roughly equivalent to the Aircraft Industrial Atom) refusal comment on orders, prospective customers, delivery times and prices when queried at the

Leipzig Fair. "We are confident of plenty of business," said one official, "but to give out such details would put ourselves at the mercy of our competitors."

East Germaners are to start next year, and the Eastern Deutsche Luftfahrt will start service with the plane at the same time.

East Germans at the fair appeared sure that they had a winner, over the BB-152's 400 mph to the existing world range of jet planes. The original Sozial Aviation's Cessna as the only real plane in class, and feel they have a edge over it on passengers per dollar.

In addition, they claim there will be



BB-152 transport begins its first run on first flight from Dresden, August. Note prototype's nose, wheeled and tail gear.

in competition within the Commonwealth Bloc. Just economic planning and industrial division of labor have established Russia as the sole producer of large jet transports with Czechoslovakia concentrating on paratactical aircrafts.

Thus East Germany has a monoplane in its own field with main potential customers among other states.

Standard BB-152 is a 75-seater but 45- and 70-passenger layouts are also planned. For specification use has been adopted and details of the plane were revealed in the 1965 issue of *AVW* (Mar. 24, 1965, p. 22). The single-shaft engine has a 17-stage axial compressor, a combustion chamber containing annular and single elements and a two-stage centrifugal follower. It is a fixed nozzle.

Max dimensions are span 99 ft, length 105 ft, and height 29.5 ft. Normal payload weight of the standard type with 15,000 lb of payload and 21,500 lb of fuel is 35,200 lb.

Maximum speed is stated to be 772 mph at 15,750 ft. Cruising speed is 490 mph and landing speed 174 mph. Takeoff run is 1,350 ft and landing run is 1,200 ft. At 27,200 lb, takeoff weight.

The aircraft cockpit at Leipzig is located in a 10,000 ft. pit and includes a masking display of the 17 passenger windows, one over each plane's Puma 314 engine of 4,850 lb thrust, with separate exhausts of the compressor, burner, booster and combustion chamber.

Interior of the fuselage is finished in grey with strip lights extending the full length of the ceiling (AVW Mar. 26, p. 41). Design of the test (in view of two and three) showed considerable attention to weight saving and passenger comfort.

Seat weight 24 lb each and have light office frames with foam rubber cushion.

Molded headrests are fully adjustable and padded armrests on the seats prove popular for use of intra-

Strobe lights are concealed in suspended compartments at the base of the fuselage. "To satisfy operators who don't require lights," an official explained, perhaps alluding to the Russian airline. Emergency oxygen tanks are contained in fabric-covered sections in the top rear of each seat with flow distribution at the bottom.

Reading lamps are also placed in the seat backs—heads showing in passenger's view. Various panels and mod. covers of plastic elements "We here in Dresden are very cheap," and the official added.

The prestige value of this transport class is left to counterbalance the greater weight, replacement cost and trouble in the event of damage to bad weather. Furthermore, are the glass-tipped tailfin and the use of heavy



BB-152 is tested to destruction at Dresden. Also production tanks at Dresden

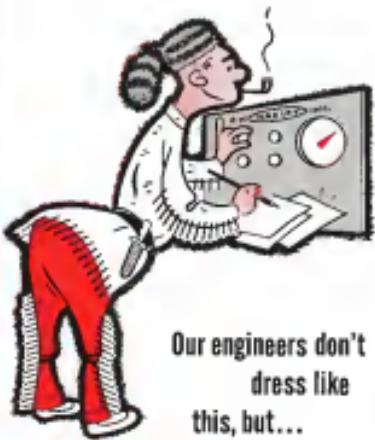


Mockup of BB-152 is displayed at Leipzig (above). The 17-passenger, interior is below



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plywood and block board for fitting parts and doors.

While the main production plant is at Dresden, the engines are designed at there and built at Lindenthal. Since East Germany formerly accounted for 64% of the country's aircraft production, it is believed that the German Democratic Republic is well placed for solid-hydrogen and hydrogen-oxygen in calculating the ramifications of jet planes.

Dresden is limited, however, and the East German industry is anxious to import from the West whatever it can to the use of manufactured materials, components, instruments and even men. According to this potential demand, more than a dozen British equipment producers exhibited their wares at a exhibition stand at Leipzig. These included Aerles and Pollock, James Booth, Elliott Brothers, E. M. I. Electronics, Fisons, High Duty Alloys, Nipper, Somond, Gobron, Richard Thomas & Baldwin, Rottal, Shanks Motor Units, Sir George Godfrey & Partners, Smiths, Stamping Works, and Swift-Clark, among others.

The use of Western components in the Bf-112 would greatly ease securing problems when the plane is sold to non-Communist operators—or is re-exported.

Elliott Brothers hope to sell solid-phase oxygenator, pressure selection system and radio and navigation aid selector. It is located with Marconi which is probing the market for radio and navigation equipment.

Cook, Kern and Nordenholz has already received an order for metal products.

Boode was asked about strategic armaments as tank exports seem the focus. He answered that East Germany could make contributions at speeds of 1000 km/h, 1200 km/h, 1400 km/h and 1600 km/h. The belief is both sides would have a vested interest in maximizing deliveries and not slowing their customers'.

Boode also made some comments on the design of the Bf-112. Concerns



PROF. BERNDOLF BOADE, designer of the Bf-112, attended the Leipzig Fair.

AVIATION WEEK, March 23, 1959



TYPE 024 propellant for the Bf-112 delivers 6,540 lb-thrust. The tanks are mounted in pairs under each side of the transport wing.



SINGLE-SPAR engine has a 12-stage axial compressor, a combustion chamber combining axial and centrifugal, and a two-stage axial turbine followed by a solid nozzle.

to Russia and British practice, he favored smaller propellant designs, but it does not detract the space frame and lifting power necessary for rate, weight, engine, engine selection and engine start and engine return nose. The higher drag is compensated for by the smaller wing required and by lower losses on sheet tailfins.

As for performance, he stated that the 15-day wing span had been successfully tested in Mach 0.9 in the wind tunnel at Dresden (which reportedly has two tunnels, low speed—175 mph, and high speed—180). In addition, he believed that the Pass 014 engine, presently rated at 6,590 lb-thrust, was capable of development to 7,700 lb. Thus, the Bf-112 could take off at 17,000 lb, fly at 10,000 lb, and land at 5,000 lb of clean weight, range greater with light load loads.

Boode told American Week that the Bf-112 was an extension out a propulsive programme. He gave several reasons for building a conventional jet in a country where production of most capital equipment and consumer goods falls below the rest needs.

\* Building aircraft provides coordinated solutions for problems arising in other branches of industry by putting aircraft design on shelves, steel, and other materials and bringing more rapid development in quality.

\* For East Germany, poor air traffic terms, if it is economically advantageous, is export practice with the highest priority to weight.

\* There is a large potential world demand for medium-range jets, and the

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New aerodynamic design, radar, sensor and engine details of the Soviet twin-turboprop Badger medium bombers are shown in these pictures taken on an operational airfield of the Red Air Force in Russia. Low level flight view of Badger formation shows details of Soviet bomber design including double wing fences, tail pipe fairing of jet engines to shelter hot blast from fuselage and tail, radio-controlled tail fairing, VHF radio antenna on upper fuselage left of Badger and lower fairing below the horizontal stabilizer, package used for long range communications, and radio side lobes just under the stabilizer. Note the large 'tulip' type ventral fin and the fixed landing gear housing Badger sits at the wing trailing edge.

## Soviet Badger Bomber in Operational Closeup

Squadron of Soviet twin-turboprop Badger bombers parked on hardstand of an operational airfield in the USSR. Note the fuselage radome just forward of jet engine air intakes and the two 20 mm. cannon remote-controlled, fixed on top of the fuselage, one of the three defensive armament installed on Badger. The view shows tapering thickness of the sharply swept wing and details of wing fences.



Takendorf photo of Badger shows four-wheeled bogies of outer landing gear, flat retractable ventral landing gear and double-wheeled inner gear with wheel well door open. Note large diameter air intakes for the 19,300 lb. thrust turbojet engines and the pressurized ventral of the wing.



Closeup of the Badger while taxying down a runway, shows details of the fuselage nose and cockpit with glass. Infrared navigation infrared port forward of usually operated twin 20 mm. gun mount. Note housing radome protecting from fuselage belly pan below ventral radome.

Closeup of Badger from the rear (in sight shows left wing type ventral fin end-cowl of the plates radome and tail of fuselage and horizontal stabilizer. Note extended tail-disk below fuselage to prevent air bypassing down high angle of attack lateral and under fuselage part above tail fin in ported area being camouflaged. Third tail 20 mm. mount is visible on bottom of fuselage forward of the extended tail-disk. Note active use of Badger as compressor to shepherd aircraft Soviet gray track parked under wing of second Badger at top left.





**SIKORSKY S-38** will give Coast Guard close-to-all-weather capability for search and rescue. Maximum gross weight is 15,360 lb. Weight R3374945 develops 1,575 shp.

## Coast Guard to Receive Six S-38s With Nearly All-Weather Capability

Stratford, Conn.—United States Coast Guard, among all its fleet assets divided between helicopters and fixed wing aircraft, will take delivery during the next two months of six highly maneuverable Sikorsky S-38 aircraft.

Helicopters, which will be the first Coast Guard aircraft with close-in all-weather capability, will give the service a range of 150 nautical miles on one engine. The Coast Guard's present aircraft fleet of Sikorsky R43S-24-190s can range 150 nautical miles due to a reason, with wife weather capability because of lack of instrumentation.

Coast Guard presently has 137 aircraft, 73% of which are fixed wing. Totalman 30% helicopters, 50% airplanes, was advanced by this service after a pro-long re-evaluation of Coast Guard requirements. Requirements call for an aircraft inventory to 155 aircraft, of which 99 would be helicopters.

Program is considered already approved in principle, since the cash plans of it were submitted to the Treasury Department and Congress in 1956. This is the third year in which the early part of the program is being implemented.

The early phase has limited itself to replacement of older aircraft, including R43s and S-34s.

Twenty-nine total aircraft

are to be in pleasure boating and/or commercial. The S-38, which can carry 16 passengers (in comparison with the R43, which can carry 10), has a maximum gross weight of 15,360 lb. Power is supplied by one Wright R3374945 engine developing 1,575 shp.

The weight of helicopter with armament equipment is 13,310 lb. Axial load factor, maximum centrifugal on left side of cabin, holds 150 gal. Cruising speed is 88 kt., maximum, 147 kt.

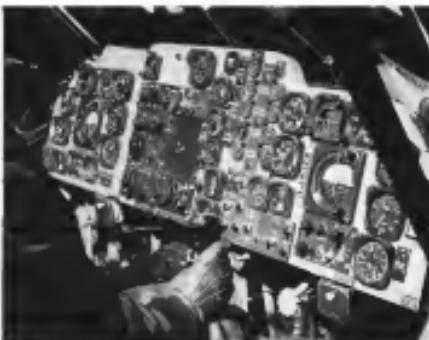
### S-38 Instrumentation

Armament equipment installed in the S-38, the Coast Guard version of which is one of the most heavily instrumented helicopters ever built, includes the following:

High frequency ARCS, ARCS 95 and Collins VHF ARCS-15 UHF homing, with VHF carrier selector 3-41 low frequency ADF; Trans R-21 backup for normal ARCS-15 arm ARCS-15 glide slope; ARCS-12 marker beacon; ARCS-17 ground speed scale; color and ARCS-117 altimeter.

Automatic obstacle avoidance equipment (ASO) will allow the pilot to hold a given ground speed from hover up to 50 to 550 ft. above the ground surface, and will be made ground stable in flight.

The aircraft will assign three of the new S-38s to the 8th station in St. Petersburg, Fla., and three to its all helicopter air detachment in New Orleans, La.



**S-38 Instrument panel** Sikorsky can furnish and receive on HF, UHF, VHF bands, including air glide slope, marker beacon and visual, with Trans homing for latter.

AVIATION WEEK, March 23, 1958

## French Opinion Split On Mirage IV Bomber

Paris—Proposed to serve along with a larger Mirage IV bomber as the French Mirage IV strategic bomber, one aircraft is likely to be forced cancellation, plus difference of opinion among French military officials as to whether the project is worthwhile.

Patt & Whitman J75 turbojets are being considered as powerplants for the more powerful Mirage IV (AVM-16, p. 351).

Current version of the Bristol Mirage IV stated to make its initial flight next month is powered by two SNECMA Atar 9-shaftengines, each developing about 15,200 lb. thrust each. This aircraft, commanded by the French in its initial trials as a development vehicle, is a larger Mirage version (AVM-16, p. 351) originally weight about 25,000 lb.

Originally, the French had planned to power a larger Mirage version with two SNECMA Super Atar turbofan engines of developing from 14,000 to 20,000 lb. thrust. This Super Atar is still in the development stage. New developments in French air force thinking appear to favor using such with a larger Mirage IV heavier of some 40 to 45,000 lbs. and install two Pratt & Whitman J75s. Other powerplants also being considered as advanced versions of the Bristol Orpheus and Rolls-Royce Conway, though apparently the Pratt & Whitman J75 will be chosen.

In a decision, it appears that SNECMA Super Atar engines will be selected. In the big strategic category, in out of the running, SNECMA, however, would probably build under license whatever powerplants eventually is chosen. SNECMA is also in the license working with an English Avon 511 turbojet, and version of Pratt & Whitman's J75. French government decision is expected within the next few weeks. It is not yet known how many aircraft French government has in mind.

## PRODUCTION BRIEFING

**General Electric Aircraft Engines** Tribune Dept., Los Angeles has received a \$70,000,000 dollar contract for the production of constant speed drives for the McDonnell F4H fighter. The company's 14H constant speed drive contract was sold for \$10,000,000 that employs spherical planet in place of conventional gearwheel mounting technique.

**Minnesota-Honeywell** Regulator Co. will supply fuel economy system indicators and fuel tank gauges for the Boeing KC-135 jet tankers under \$100,000,000 Air Force contract.

**Loiselle Oxygen Co.**, division of Union Carbide Corp., will build a liquid oxygen and nitrogen producing plant near Thennville, Ala. Facility, scheduled for completion in 1960, will have a capacity of 100 million cu ft of liquid oxygen and nitrogen per month.

**Howmet Standard Division of Uni-rod Aircraft Corp.** will produce using atomic equipment to melt Ti-6Alum, grain being stabilized to Ti-6Alum. R&D program will involve some 1,000 development units.

**Cong System, Inc.**, Lowell, Mass., will build helicopter-portable commun-

cations systems for the Army under \$1 million subcontract. Shipment to port of Seattle in part of \$12.6 million prime contract held by Showa Carbon for the communications system for the Army's port transport, about twelve, battle fleet two.

**International Aerostatic Division of Industrial Avionics Co.**, Inc., New York, N.Y., will supply Comair, Fort Worth, with a multi-jet diffuser nose fairing for placing ground crews at B-52 capsules. Part of a Comair early development program, fairings are designed to handle full afterburner power of the General Electric J79 engines.



### Stranger on a Strange Stand

The Place: The new Airwork-Nielsen Accessory Shop. The Strange Looking Device in the Foreground: The pump and fuel control unit that makes up a jet engine's fuel control system.

With that, a leading piston engine overhaul agency enters the jet age—by overhauling the most complicated unit in the jet engine system. In the process, Airwork will set new performance standards. And, for example, the flow meters on Airwork Test Benches see four times more wear than those used in current stands. And, Airwork stands see to make that they can accurately simulate the operating conditions of any of the test stand systems now in use by accessory and engine manufacturers. This makes it possible to check any of today's performance standards on one stand!

You may not be flying jets for several years. But, when you do, Airwork will be ready with the skills, the equipment, and the industry leading standards they have already established for piston engines. Quality in jet accessory overhaul will be ready for you!—when you are ready for jets.

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# CAN SYNCHROS

## BE MOISTURE- PROOFED?

Thanks to the special materials and construction of improved Ketay synchros, the moisture-resistance standards of MIL Spec 2078B (outperforming all previous specifications) can be met or exceeded. Many of these special materials and design features are exclusive with Ketay... the only source currently manufacturing and shipping a wide range of the new MIL-type synchros.

Stainless steel housing, shafts, and bearings... rotors potted in anti-damp epoxy resin... hermetically sealed windings... thru-bore construction for lower parts and less space where moisture can collect... these and a variety of other Ketay features all give extra protection against moisture damage.

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**NORDEN** Division of United Aircraft Corporation

KETAY DEPARTMENT, Commack, Long Island, N.Y.

## Wall Street "Electronics Boom" Sends Ryan Stock to New Highs

**New York Stock Association:** On the latest among a handful of company to find itself in a market in demand with customers for its products, during which the price of its common stock doubled in a month.

Nothing dramatic new or different in Ryan business really accounted for the spike—except the possibility of a stock split.

Though stockholders last week approved an increase in authorized number of shares, no word of a split came from the board of directors. However, the company did report an increase in earnings for the first quarter of 1957, from \$110,000 to \$596,000, or from 95 cents a share for the same period the year ago to \$1.01. Sales rose 51% to \$1.3 million.

Several factors contributed to the rise, but the center of the attention probably was the sharp increase of 40% in the investment community rather than anything Ryan did to attract attention.

Last fall year the word began to spread around in some investment firms to watch Ryan. The Wall Street grapevine plus the negotiations of Ryan with the state with two numerous companies for a long term lease of \$4 million added fuel to the fire.

On Feb. 9 Ryan shares were selling on the American Stock Exchange for \$13 a share, up 10 cents from the 1955 price range of \$12.50. Ryan's all cash was \$10.5 million in 1956. Its bank stock price had set \$68.60 before selling off slightly.

Wall Street's major role for the aerospace electronics played a major role. Ryan has just received a \$20-million letter contract from the Navy for an embodiment of the Doppler APN-122 ground speed drift angle system and has started other programs in this field.

Ryan is exploring in this phase of its business, pointing out that the Navy is going to the maximum rate. Doppler units will then go into the Doppler range believed to be U.S. 10% and that Ryan would be in a good position to benefit because of extensive work in this field.

Over interest was aroused in Wall Street, the figures in Ryan's 1955 financial report were translated into price projections for the future. Based on \$18.30 shares issued following a stock dividend at year end, Ryan earned \$4.74 a share or a ratio of 90 cents over 1957. Earnings of earnings of \$1 or \$1.50 a share thus far reflected, Ryan's sales volume, \$7.5 million last year, would be four times more in a year or two, the re-

sults on a more or less permanent basis, the number of shares available for daily trading on the exchange is relatively small. Such situation often drives prices up sharply, as in the case of Lufkin Steel or Boeing, instances.

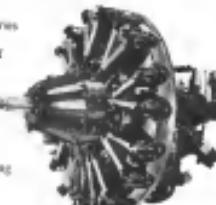
• The 1,000,000 additional shares of stock authorized last week in Ryan stockholders gave rise to the stock split preference. As one forward analysis put it, Ryan has now reset an option with dividends in the past. Now it looks like they are going to make up for it.

One reason given for a split would



## Compact - Reliable Power

The Alvis Leonides 510 series engine provides a reliable and compact power unit of 600/825 B.H.P. with an overall diameter of only 43 inches. Developed from the Leonides for many years the reliable power unit of this Royal Air Force is available for installation in both fixed wing aircraft and helicopters.



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# How Titanium licks the weight bogey in components... A STUDY IN MACHINING SUCCESS

Today's aircraft component manufacturers are getting squeezed from two directions: If tight allowances of complex parts are being drastically reduced... but redesign costs to shave off a few ounces of excess "fat" cannot be written off in the short-run orders of the current market.

If how can the manufacturer do? Should he trade profit for good will, or should he simply give up, and yield his position in a market with such excellent potential?

**Titanium Metals Corporation of America has found increasing case-history evidence that an economically sound compromise exists: Substitution of titanium for heavier materials, on a volume basis. The results: a lighter assembly; elimination of redesign costs; and no excessive equipment purchase or modification.**

Best news of all, the finished product can be marketed competitively. Here's the proof:

There's an old chestnut, held over from several years ago, that titanium is next to impossible to machine. This belief goes back to the time when fabrication techniques for the new material were still being developed. Today, though, the picture has changed!

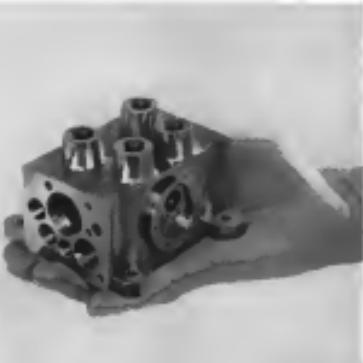
## ... prefer machining titanium to... stainless steel...

Coddie Gage Company, Warren, Michigan, has substituted Ti-6Al titanium for a high nickel alloy in valve bearings designed for North American Aviation's AJJ Navy attack aircraft.

Titanium confers the properties that ordinarily require a series of materials. Lightweight titanium is non-magnetic, corrosion-resistant and retains its great strength from -360°F to +1000°F. What does titanium mean to Coddie Gage in production of valve bearings?

Weight savings: 2½ lb. Sise of connector: \$300,000.

Project Engineer Robert Mellott states: "Our shop personnel actually prefer machining titanium to some grades of stainless steel. And the use of titanium has added no more than 2½ to 10% to the final cost of the valve."

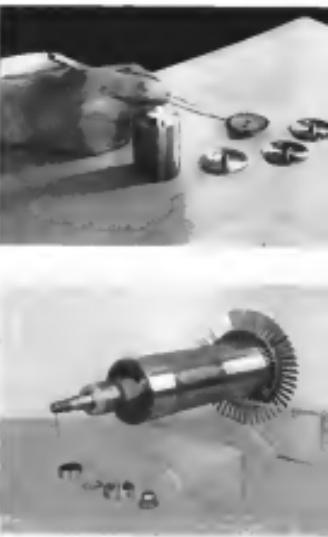


## ... case in machining... competitive with plastics...

Fischer Machine Company, Philadelphia, manufactures titanium on conventional equipment, holds tolerances to 0.0002" on ½-inch turbine wheel 1½" in diameter, has costs for \$60,000 in titanium parts.

The turbine wheel, which rotates the generator in Philco's 150,000-watt Schenckard missile, reaches speeds of 60,000 rpm in a fraction of a second. The application calls for a low density material with great strength and heat resistance. Fischer employs annealed Ti-6Al-4V (1300 MPa yield strength, density 0.163 lb./cu. in.) for the job.

General Manager John Saitto says: "Recent price reductions and our own cost-cutting have enabled us to make the price of our turbine wheel competitive with machined plastic wheel. There is, of course, a price difference — but that's more than offset by titanium's vastly superior performance."



## ... titanium helps hold rotor weight to 20 pounds...

General Electric Company, Lynn, Massachusetts, has introduced a new concept in electrical power generation which combines the generator and turbine into a single self-cooled unit. It's called the Turbogenerator.

Turbine and rotor — both on a common shaft — operate at 24,000 rpm. Titanium substituted for steel in top shafts and rotating rings enables GE to hold rotor weight to 20 pounds, and achieve efficient turbine speeds, because non-magnetic titanium can withstand high centrifugal forces.

John W. Herremans, project engineer, reports: "The Turbogenerator has package size 50% and cost 20% from conventional turbine-generator systems. It's versatile and can be used anywhere there's a jet engine."

and maintaining a referral program by which prime contractors may locate component manufacturers of demonstrated ability.

Enterprises into titanium can mean immediate cost reductions and establish your firm in the long-term future. Contact the TMCA sales office in the city nearest you for further information on how titanium can help you.



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## Missile Systems Funds: Fiscal 1946-1960

Expenditures for missile programs will drop by about \$400 million in Fiscal 1960 below the Fiscal 1959 level, from \$7.2 billion to \$6.8 billion, according to figures released by the Defense Department. The major driver, \$130 million, will be in ballistic missile programs—from \$2.9 billion in Fiscal 1959 to \$1.7 billion in Fiscal 1960.

Following are the details in millions of dollars. Figures reflect all procurement, construction and research and development programs directly associated with Defense Department missile programs. They do not include military pay, operations and maintenance costs for intercontinental ballistic missiles used in orbit.

Fiscal Year	IR/ICBM Programs	Surface-to- Surface Missiles	All Other Missile Programs	Total
1946 (and prior)	—	15	51	76
1947	—	26	56	82
1948	—	56	41	97
1949	—	41	51	92
1950	—	61	56	117
1951	—	181	98	279
1952	—	209	111	320
1953	—	236	111	348
1954	14	266	136	426
1955	—	186	181	367
1956	318	187	280	585
1957	1365	661	2182	4108
1958	2077	679	2193	5209
1959	2966	726	3129	6221
1960	2716	187	1494	4307

\*\$2.3 million was programmed during the period to the USAF MX/SD-74 ballistic missile research program, predecessor of the Minuteman ICBM.

to increase the number of Ryan production lines, now about 1,000, to the 1,300 required for fitting on the New York Stock Exchange. Sales for 1,000,000 share authorized was within one-half issued. The new authorized total is 2,000,000.

Consequently, Ryan could still share caught rather than being caught, but independent sources thought that unlikely.

Ryan said a group of money had sponsored on the West Coast with the stock price rise—such that Howard Hughes was leaving the company, though obviously gratified in the rapid appreciation in the company's stock, Ryan officials said they knew of no reason for it beyond these already disclosed.

Rapid as it was, the Ryan springing is no record breaker. Thirteen companies, for example, took a look at 1960 and just after a stock split to a high of 150 million.

## Investors Respond To KLM Debentures

New York—KLM Royal Dutch Airlines found a highly favorable investment climate in its sale of \$18,400,000 in convertible debentures to finance its part \$40 million in additional jet orders—either for more Douglas DC-9s or for Boeing 707s or Convair 880s.

KLM has eight DC-9s now on order and the use of the program indicates its eight more replacement will be bought. Twelve Lockheed Electras and two Fokker Friendship jets are on order in a total \$57 million program. A revolving credit agreement with the First National City Bank of New York, the Chase Manhattan Bank of New York and the Bank of America National West Coast Savings Association has been increased to \$70 million—down \$5 million to \$70 million—to give KLM the remainder of the \$17 million of funds an external financing for the new orders. External sources are expected to provide the balance.

KLM is the second foreign airline to obtain additional U.S. financing previously for U.S. manufactured jet equipment in the last few weeks. Scandinavian Airlines Systems obtained a \$13 million commitment from a group of banks, and also the First National City and the Bank of America National West Coast Savings Association has agreed to finance up to \$10 million. So, said Convair's John Cooper, KLM has also to return the balance outstanding from an earlier U.S. line financing.

Enough cannot have turned to the U.S. for financing largely because of more limited capital available in Europe, nevertheless here we are.

The market has responded to the KLM sale by taking a \$11 premium on each \$100 of debentures first day of the

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- 3 **Process Development Links** for use in welding, joining and bonding.
- 4 **Service Institutions** to help solve production problems in your plant.
- 5 **Quality Guidance** to assist in design, manufacture and to match your special needs.

- 6 **Availability** guaranteed through the nation's best stocking and delivery distribution.
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INSULATION AND RECOVERY



## THE ALUMINA CARPET: SPRINGBOARD TO THE STARS

THIS IS one of our much-needed launching pads. Someday, when we have not only orbited the moon, but we have sent our gleaming warheads to Mars and Venus and beyond, we may become a nation above. With a plaque that says, in effect, "Here it all began . . ."

**RIGHT NOW**, it's not especially exciting compared to the exciting things that have happened above it—unless you're interested in modern industrial refractories. Then you'll realize that this pad, like other major missile-launching sites in the United States, is paved with materials containing aluminum.

**WHY ALUMINAS?** Because the boldest of heat from a missile's

takoff makes the interior of a blast furnace seem cool by comparison. Because only modern ceramic technology, working with today's advanced materials, can produce a paved pad that takes such a blast in its stride . . . and then stands ready, willing and eager for the next shot.

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strong, lightweight Alcoa Alumina alloys themselves, of course, are more essential than ever in advanced aerospace and missile production.

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For facts on the best in Alumina Refractories, contact:



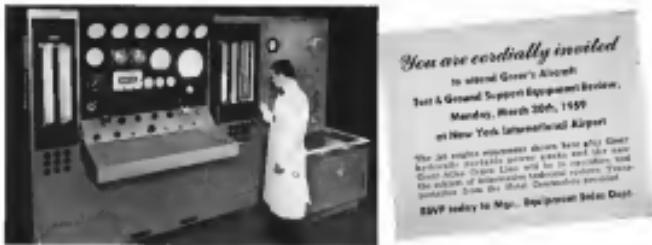
# FIRST COMMERCIAL JET ENGINE COMPONENT OVERHAUL FACILITY AT N.Y. INTERNATIONAL AIRPORT



**How ready for today's jet!** The Green equipment pictured is built for SMC Instruments & Accessories, Inc., for their expanding overhaul facility at N.Y. International Airport. Illustrated are the fuel pump, fuel nozzle and fuel control machines designed to test components on the P & W JT4 and

J75, Allison 501D15 and GE C3406 jet engines. While in New York for the SAE Aeromatic Meeting, visit us at the Equipment Review held at our plant or at our SAE display booth. See for yourself—Green is ready now with the most advanced and reliable jet test and ground support equipment.

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site. The terms of the financing are generally on line with most recent U.S. aircraft financing—interest rate is 4.1% and the pay-back period is estimated to be around 5-1/2 years. KLM management thinks this was quoted at approximately \$33 a share on the New York Stock Exchange last week.

Besides the general appeal of convertible debentures in aviation now, the implicit backing of the Dutch government for the airline even though it has been gradually reducing its investment in the airline, is given as a reason for the premium price of the issue.

More \$8 million of the issue was sold in Holland. Investment men are wondering whether these will gradually find their way back to the U.S. because of greater U.S. demand—or whether some to pay higher rates in the U.S. The size of KLM was based on the market here for the first time in May, 1957.

## Blount Construction Gets Atlas Site Job

Cheswick, Wyo.—Blount Construction Co., Montrose, Colo., appears to be headed to contract with Atlas missile launching structures at their new launching complex with a low bid of bid of \$12,472,384 for the three sites.

The contract call for construction of one launch and service building, three launch operations buildings, three power and pump houses, five well pumps, installation of zinc gastron, water lines, access facilities, underground electrical system, paving and leaching.

Three Atlas missiles will be stored for firing at a potential enemy target when the construction is completed. Completion date for storage facilities will range from next October to late spring of 1960. The test facilities are expected to arrive in Cheyenne shortly before the first of the year.

## Fairley Changes Name To Become Holding Company

London-Fairley Aviation Co. Ltd. has changed its name to Fairley Co. Ltd. and will become a holding company for 10 subsidiaries. A new organization, Fairley Aviation, Ltd., will take over the company's aircraft work in Great Britain.

In another move, Ministry of Supply Anthony Jones said the government will review its involvement in developing an advanced, \$17 million version of the Folland Rotodyne—powered by Rolls Royce T54 engines. Jones has ordered a review. The government has agreed to contribute half the resources and to coordinate the development. (AW Mar. 16, p. 35)



## the only jet-starter hose with government approval

Rugged Quaker jet-starter hose is the first and only hose of its kind to receive U.S. Government approval for use in starting jet engines.

500° air under great pressure inside—arctic temperatures outside—can't hurt this hose. The invertible whipping under jet-starting pressure never causes air blockage from kinking. Hose length remains constant under pressurization and de-pressurization. And the extra spiral staff jacket on the outside takes the roughness abrasion while maintaining the flexibility necessary for quick ground operations.

Get complete information on Quaker jet-starting hose from your local Thermoid industrial distributor, or write Thermoid Division, R. K. Porter Company, Inc., Tacony & Comly Sts., Philadelphia 22, Pa.

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Midvac Alloys insure increased tensile and impact properties, improved stress rupture strength at elevated temperatures, and longer fatigue life.

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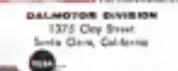
Motor Generator



Temperature Motor

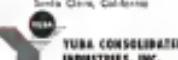


Temperature Generator



Temperature Motor

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# EQUIPMENT



**TRAILER** which transports and loads Convair B-58 Hustler pod over largest and most powerful for the Inchetron boom and is self-propelled. Single operator loads the pod, using a 15 lb. control box which is strapped to his chest.

## Flexible Loader Developed for B-58 Pod

By Craig Lewis

Douglas-General handling system for storing, handling and loading the various pods which are an integral part of the Convair B-58 strategic aircraft under development here. In Space Corp.

The special ground handling system was devised for the B-58 when a license came in that ordinary loads handling equipment wouldn't adequately fit the precise job of positioning and loading required under the new pod concept. Space Corp. is building three prototype systems for evaluation in addition to a dozen of General Dynamics Convair.

A key element in the B-58 weapon system concept is the flexibility inherent in the use of a variety of pods with the base airplane to perform a variety of missions. The Space Corp. system is flexible enough to handle any of the pods planned for the bomber. It could be adapted to handle any air-launched ballistic missile or such a weapon as developed for use with the B-58.

The ground handling system has three main elements, and they do the job of storing the pod, transporting it to the loading area and loading it on the aircraft. Load compensated in these three areas the storage and transport areas are designed to stay compact and supported on stationary legs. The storage area can be used to transport a pod on a mobile cart or roll it in an air transportable truck. It is designed to withstand a 90-lb. wind with the pod in it.

The part of this system which is a key part of the whole system, the truck, the transport trailer and the loading trailer all have rails of the same type and track width, and any of these pieces of equipment can be moved and their rails clamped together while the pod in its trailer cradle is cranked into one to the other.

Second basic piece of equipment is the transportation trailer. It can be towed by standard military vehicles in storage bags and it can also serve as a carrier for equipment in cargo aircraft, rail truck or ship. The trailer has a flat top, no fenders or bumpers, and it has a flat top to the trailer itself. When this system is plugged into the loading trailer it furnishes the roll motion to the ultimate job of walking the payload place.

Third basic element in the system is the transport trailer, the loading trailer. This is the vehicle that moves the pods onto the B-58 and moves it off again. It is 105 in. wide and 14 ft. long and can handle any pod up to 6 ft. in diameter. The trailer is designed to carry the last of pod gear planned under the current work with a 7 in. clearance when the trailer is depressed to its lowest point and the bowser's landing gear goes over all the rear door.

Powered by a 10-horsepower motor through a chain drive, the loading trailer is self-propelled. Although designed for the positioning and loading job, it can be used for aircraft loading and unloading, and it can be towed by standard vehicles. Systems have an hydrodynamic braking for road use. A robust lever is used to hold the pod in place. A standard hydraulic header for positioning work, and a manual overhead system to lock it to the cart in place.

A flexible motor is driven by an electric motor which gives it power from a



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The Cessna U-3A is now in operational duty with the U.S. Air Force. Its speed—the highest speed of any U.S.A.F. light twin transport—and its range and versatility are proving highly valuable in meeting administrative mobility.

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cabin mockup in a pressure tank maintained at 5,000 ft. pressure altitude, and adding 658 lbs. input. All cabin surfaces were heated but particular emphasis was placed on canopy glass, which may experience nonuniform heating of about 2000°. Test subjects in the cockpit reported no perceptual discomfort during the test although condensate surfaces were at approximately 200°.

Air flow rates higher than 50 lbf/min were tried and rejected due to higher noise level and interference with nose lifting, prop washing. Final cabin heater level of 50° was reduced through optimum cabin temperature of 25° at the 50 ft. cabin pressure.

An attempt at liquid cooling cockpit was made because about complete absence of insulation on high altitude aircraft causes uncomfortable discomfort even after short flights. One 210lb. test subject lost 12 oz. in that period. Water heat was provided each subject to use, and although it contributed to the overall cooling effect, it was concluded to be "too messy" for inclusion in an aircraft cockpit. Ideally, water could be introduced in the form of fog but nozzle to give droplets of the required size would be extremely difficult to produce. Problem would then be to provide clean efficient enough to prevent clogging.

Additional work is being done on problems of types environmental from the on conditioning standpoint. One in solving the problem of spacecraft environmental may be in recent advances in the art of liquid gas storage.

## WHAT'S NEW

### Publications Received

1975 Directory of Missile Manufacturers—by editor of Federal Procurement & Subcontracts Data, and R. D. D. The Research and Development Weekly—Pub. Federal Procurement Publications, Inc., 10-42 40th Rd., Long Island City 1, N.Y. 11201, \$25 per year.

This series lists names and addresses and their addresses, programs, products, processes, methods and services.

Aircraft Electricity for the Mechanic by Charles Edward Chapel—Pub. Aero Publishers Inc., 55 30, 47700.

Fundamental principles of electricity, operation, maintenance and inspection are contained in this book.

Gilding—by Donk Puglisi—Pub. The Merril Co., 68 Fifth Ave., New



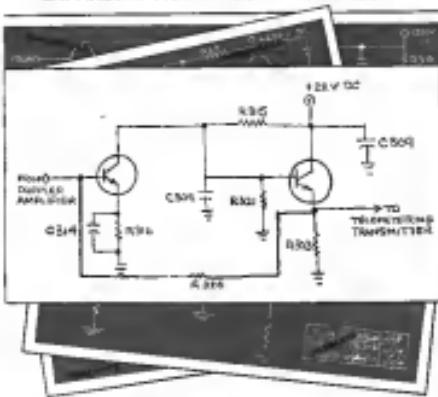
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York 11, New York 5500, 261 pp. Handbook of soaring flight for pupils and instructors.

1959 Directory of Guided Missiles—edition of "Federal Procurement & Sourcebooks Daily" and "B & D", The Research and Development Weekly-Pub. Federal Procurement Publications Inc., 10-02 11th Rd., Long Island City 1, N. Y. 1 of 1,000 \$1.00 per copy. Missiles specifications are given in full, including data on engines, warheads, nose cones, guidance, ground support, propulsion, test and track equipment.

1959 Directory of Government Missle Agencies—by editor of "Federal Pro-



### British Altimeter Change

British Air Requirements Board is requiring modification of British Borean altimeters because of incompatibility to altimeters at 10,000 ft. New presentation is as follows: old, old display at right. At 30,000 ft. (top) there is no low level warning flag showing on new display. Below there is a long length of the dial in which the 10,000 ft. is at 11,000 ft. (middle) and the 10,000 ft. is just below the 10,000 ft. marker. Deploy the ring on the 10,000 ft. marker (not standard) and all altitudes over 10,000 ft. pointer is profile obscured. On one presentation the low level warning flag is showing in low level mode. Length of the follow up has decreased. At 1,000 ft. (bottom) a large area of low level warning flag shows on new display. Follow up has almost wholly about.

For more about current projects and how your professional services can be fully utilized, please phone Maynard, Massachusetts, 7-Winona 1-2865. Ask for Mr. Fred Prystay, Jr. If you prefer, write him for details. He'll be glad to arrange an appointment at your convenience.

Missile response controller and an overall Vanguard satellite boost vehicle complete prefabricated steel tape to provide all three kinds of command for controlling supply for patch single programming stage separation and separation. Designed and produced to be open for industry, Inc., Cleveland design weight less than 6 lbs., measures 41 in. diameter and 36 in. long. Power source selector is obtained from conventional controller which power needs are direct control.

component & subcontractors Daily and "B & D". The Research and Development Weekly-Pub. Federal Procurement Publications Inc., 10-02 11th Rd., Long Island City 1, N. Y. 1 of 1,000 \$1.00 per copy.

This issue deals with purchasing, advertising, program, research and development, products and materials.

Solution of Problems in Aerodynamics—by S. A. Urie, B. S. E., A. F. R. A. M., Scientific Publishing Corp., 2 West 15th St., New York 9, N. Y. \$6.75, 1958.

Contains 400 problems selected to give aerodynamics students practice, and also contains contributions of engineering institutions.

As the Pic Flies—by John R. Hagen, Jr., McGraw-Hill Book Co., Inc., Trade Books Department, 120 West 33rd Street, New York 1, N. Y. \$5.95, 271 pp.

This book outlines how to improve basic flight skills and master the more advanced techniques of flying.

Fundamentals of Radio Telemetry—by Marvin Upper-Job, Radio Publisher, Inc., 116 West 14th Street, New York 11, N. Y. \$1.95, 368 pp.

The field of radio telemetry is covered to the limit, which explains its popularity and explains its techniques.

Bonded Aircraft Structures—Pub. Ellis (A. R. L.) Limited, Oxford, Cambridge, 57-58, 17 pp.

Book composed of papers given in Cambridge at a conference arranged by Aero Research Ltd., Duxford, Cambridge, 1957, concerning bonded aircraft structures.



### Vanguard Program Timer

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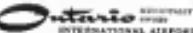
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\*Patent applied for.



## BUSINESS FLYING

### Fewer Pest Control Programs Mean Tighter Competition for Sprayers

Leveling off last year of big-scale pest control programs—in some cases covering several states—is expected to show which scattered figures say, as that significant aviation operations declined compared to the fire season of 1957.

Indications are that control authorities for the big projects will occur in 1959, accounting for a temporary plateau for most spray-plane operators this year.

Operations supervised by the U.S. Department of Agriculture provide important clues as to the overall aviation service in those fields available data in last year's work and that planned for the current period indicate that its programs will fall for work at 1958 levels in most areas, lower in others.

#### Flight for Business

Flight contracts will mean heavier competition among operators and probably an increase in the problem of controlling rate cutting as a desperate attempt to gain available business.

Commercial operators under state and federal contracts, with forests and orchards, are the main users of aerial spraying, and the cost of pest control last year.

Guidelines, imported fire ant and Japanese beetle programs are expected to be of equal interest this year. More than market changes it is expected to be

• **Gypsy moth operation** in Pennsylvania covered approximately 517,000 acres at a cost of approximately \$6 cents an acre, including materials.

• **Ground beetle work** in Montana, Idaho, Wyoming, Colorado, Texas, Nebraska, Kansas, California, Oklahoma and New Mexico extended covering approximately 47,500 acres at a cost of 75 cents per acre.

• **Mountain cedar contracts** in Nevada, Utah and Idaho, worked over 73,000 acres at a cost of \$1.40 per acre.

• **Imported fire ant** was hit in Texas, Louisiana, Alabama and Georgia for a total of some 400,000 acres at a cost of \$3 per acre.

• **Japanese beetle** was attacked in 11 states and 1,000,000 acres at a cost of \$5 per acre.

• **Pink bollworm** was hit in Arizona with operations covering 100,000 acres, including re-treatment.

• **Mediopterous fruit** hit was wicked over in Florida where 10,000 acres were treated at a cost of \$0.90 cents an acre.

One of the big projects in 1957, this was completed at the last few months of last year.

Guidelines, imported fire ant and Japanese beetle programs are expected to be of equal interest this year. More than market changes it is expected to be

less than in 1958. Some other programs are completed, including a few that were under way last year.

U.S. Forest Service last year reported spraying of approximately 850,000 acres in mixed forests, mostly in the Pacific Northwest area, against mountain hemlock, and an additional 750,000 acres in state and private lands under similar insect pests. The total on these projects are expected to encompass only about 700,000 acres.

Forest Service continued to make big gains in use of airplanes for fighting fires last year—statistics show that approximately 1,442,000 gal. of fire retardant chemicals were dropped from the air, more than double the previous year. Fired wing aircraft were flown more than 22,071 hr. with Forest Service aircraft accounting for 4,945 hr. and chartered commercial aircraft for 17,154 hr. Helicopters, newly popular in commercial operation, put in 3,746 hr.

#### Parachute Jumps

In these fields, fighting erosion, 308 forest fighting personnel made 2,713 parashute jumps.

Forest Service also accounted for carrying 25,013 persons, mostly for lighting and smokejumping commercial aircraft. A new technique of parashute jumps from helicopters, known as "hot dropping," 21,300 ft. out of 714,470 ft. claimed in all types of aircraft. Another 770,000 ft. of cargo was added from field to field. Use of helicopters in forestry work increased by approximately twice, with these major advances being in the Pacific Northwest, the Forest Service report.

In addition to unusual hazards associated with operating work, and increasing competition, another troublesome problem is making the agricultural industry better fit the fleet. This is an increasingly intense attack on spray-plane operators to reduce losses who own their aerial operations as instruments of their trade.

Heavy spraying is being brought to bear by the Acid Rain Society. Avenues Work was real. Last year, legislation in two states had felt that, if passed, would have granted aerial applicators in these areas. Operators report that when the aerial spraying is built on peaking aerial application legislation, they are greatly embarrassed by severe restrictions of operations representing revenue losses.

As far as climate seems operators last year won a struggle against the 10% transportation tax that they have been paying for often means the difference in their being able to compete with general transportation, and, from a number of factors. Department of Defense Services, which operated the general of the裁, argued that the government



Mexican Bank Gets Fairchild F-27A

Bank of Mexico's new Fairchild F-27A, powered by Pratt & Whitney R-1820-85 2,000-hp engines, leaves the manufacturer's Belpre, Md., plant on its delivery flight. It was the fourth F-27 delivered to a corporate customer. Previous corporate delivery was to General Tire & Rubber Corp. Jetstar purchased, Houston & Houston, Ft. Worth, Tex. It is destined the cabin of Bank of Mexico's airplane as well as Westinghouse Electric Corp.'s and West Germany's F-27s.

## Acoustics Engineers

Our recently established acoustics laboratory offers ground floor opportunities to qualified acoustics engineers. Facilities also with experience in measuring and testing both intensity levels, analytical engineers capable of predicting spectrum of noise from various sources, and structural engineers able to predict acoustic effects on missiles and aircraft are all needed immediately.

**Analog Computers**—Our RADAC (Research and Developed Analog Computer) laboratory has recently been expanded to a 300 amplifier family. This group has interests for mathematicians and engineers capable of programming and solving problems of missile and aircraft design arising from all engineering areas. IBM 7090 computer available to augment analog equipment. Qualified engineers are invited to send resume to:

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ENGINEERS! Write Mr. Des Ligneris for your copy of a paper on "Airborne Early Warning in the Missle Age" presented by Robert A. Bailey, Chief Engineer, California Division, Lockheed Aircraft Corporation, at the 6th USAF World Wide Weapons Meet.

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### Speed Attempt

Merle Jones Cobb will attempt to set a new world's speed record, Category C-1B, over 1,367 mi., now held by the USSR. Attempt, to be made during Weeks Congress of Flight, Las Vegas, April 13, will utilize a twin-engine Aero Commander 680E business plane to repeat the mark established in 1959 by French Edouardouze in a T-33. His and others' will be submitted to Federation Aeronautique Internationale for confirmation.

world low an estimated \$12 million to achieve this year, indicating that set tax and charity is saving a total of some \$10 million from the state. National Aviation Trade Assn., which led the battle to have the tax killed, said that this is a conservative estimate.

### Reading Air Meeting May Attract 5,000

An estimated audience of 5,000 visitors are expected to attend Reading Aviation Service's 10th annual business flyers' orientation and orientation meeting at Reading (Pa.) Municipal Airport. Passes are being made to handle up to 750 visitors a day during the two-day meeting, June 5-6.

The meeting, which features sessions detailing new techniques and products for the business pilot, also provides flight demonstrations of latest aircraft types. Several of the new turbofan-powered executive transports are expected to participate this year.

Plaques and trophies will also be awarded to company-operated airports in four classifications and categories. Award for you will be on aircraft providing a maximum paved and high performance. The aircraft show is not open to the public and attendance is by invitation from Reading Aviation.

### Civil Agency Fleet To Total 414 Planes

A total of 414 aircraft will be operated by various civil agencies of the U. S. government during fiscal 1964 and expenditures for acquiring and maintaining costs are expected to be \$50,244,998.

The government agency outfit will include 31 new aircraft purchased at a cost of \$12,795,000. Major aircraft assets are:

- Federal Aviation Agency, which will receive 117 aircraft during fiscal 1964 fiscal year, including three transport aircraft and four for checking and testing air navigation facilities. FAN's are craft are also used for developing flight

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solid structures, operational training and flight proficiency and logistic support of its stations in the Pacific and in Alaska.

• Disposition of Isletier, operating 76 aircraft in seven agencies, including helicopters and ten piston line patrols for the Roosevelt Row Air Armada. In one aircraft used in the T-33 gliders National Park to deliver passengers and set up search and rescue equipment.

• Disposition of the National Guard Service, which will operate 33 aircraft to prevent flight entry into the U. S. also for disposition of others. Forest Service of the Dept. of Agriculture will have 13 aircraft to transport fire fighting personnel and handling part used planes.

**PRIVATE LINES**

Emergency fuel cushion system for Lockheed Lodestar and L-1011 commercial transports by Pacific Engineering Corp. is designed to eliminate engine power failure due to severe continuous losses of ambient air flow. On sign of combustion, pilot activates the Pan-Air system, providing an alternate source of fuel pressure bypassing the mainline to air intake control and providing manually controlled mixture, offering rpm, manifold pressure and flow, auto and manual to achieve desired power. Complete kit, including oxidized and modified carburetor is priced at \$499 for a PH-1114 carburetor, \$515 for a PD12-R10. Installation of Pan-Air costs \$150 for Lodestar, \$275 for Lockheed.

Peter of 1999 Lexington, S. C. is a two-place personal plane in \$4,870. Flying factory: Ft. Collins, Colo. Sales of the 300-hp Continental powered Model 507 during the first two months of this year are reported to be better than ever. Sales are expected to be better this year also. Sales are expected to be even greater. Peter is currently developing a three-blade and four-blade propellers.

Business and private pilots are invited to fly in for a meeting of Technical Aviation Association, National Aviation Products Engineering Center at Allstate City, N. J. on the weekend of May 9. FAA will discuss plans and programs for modernization of U. S. aviation facilities. Arrangements for the twin are being directed by Robert Suggs, FAA Bureau of Research and Development general aviation research unit.

Flight school director of the International Inc. has been named by South West Aviation Corp. working with Del Tex Airlines, the former handling ground schooling and the latter flight training. Operation will Southeast Aviation's entry into flight training

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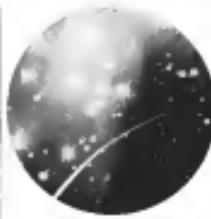
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AVIATION WEEK, March 23, 1959

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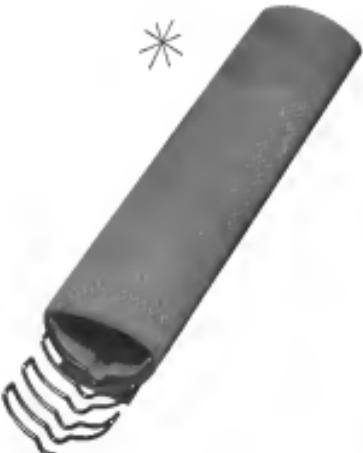
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## LETTERS

### Pilots' Comments

Rev. Edward. N.Y. 1915

I am an active pilot of a major scheduled airline and was quite impressed by your article, and agree completely on the regional identity we are the thinking public.

what photo young today will soon need: starting them not only a check of picture techniques, but also the physical condition of some.

the most serious uses of the name. We are supporting a group of professionals, and as long as I do I will continue the influence of a writing condition. That is to do. However, being professionals or not need not be the determining factor. The most active pilot who can do this, whether he is 16 or 80, is flying today. Of course, I know it can mean the liquidation of these men, but taking care at the cabin up to 140 people who also have jobs, hands and bodies to take over 40 and we do it to these people have a right in the cockpit that they can get their complete confidence in.

Let's put down our newspapers and magazine and sit a moment and do the right. Let's do, by V.F.W. what we know we should be doing. Let's not hold, restrain, pass to or can pass to the criminal part as pleased. Let's end the moment as a whole and close here off. It tells us what we do and what we cannot do and lets which is it.

I personally would like to see some signs that I am going to be an alias place and name it and to command the suspect a personal place you should have.

Massachusetts  
New York N. Y.

As a member of the *citizen planning* profession, I wish to thank you for room well intended above in the Feb 18 news item, "Revolving and Responsibility". I flag however that your advice will not be well received in the majority of those to whom it is addressed. I would like to point out also, that this does avoid these pitfalls in the future.

Regarding your concern financially and otherwise, I think most of us regard the new oil price style as one more than barely adequate. In terms of producing power, the top pad oilfield jobs is no better off than when he was in 1970 when he was facing a DUC-1. In the same oil-producing areas, the oil price is probably not off the mark in terms of production and efficiency. The oilfield industry by accepting production price increases will leave the average of other bushel pad employees in this industry. This is a major reason for the lack of hire increases over these years. More often than a short time ago, we got caught up. Our union members have been even less able to keep up with oilfield price increases.

You are quite right that we need  
more accurate thought and cannot afford  
to fully disempower their responsibility

Letters to the Editor: Letters to the Editor should not exceed 300 words and should be submitted in a typed, double-spaced format. Personal communications, letters, and reprint requests will be withheld on request.

problems. We also help management determine the expense of regular operations by collecting gas for our scheduled traps controlled by weather, merchandise and economic factors. Of course, we are allowed to make up this gas by working as days which we could otherwise have off provided the oil companies are willing.

The second case of this professor's anti-social nature. This ALPA has been in touch with other agencies. In requesting sufficient passes on these two routes who do not supply sufficient passes to traveling business. Wallingford cannot command valid passes, and as a result full passengers' not the place to catch the most important professor. In fact, the head of practice that would have prevented the Board taught that practical study anywhere but in England. Jim Johnson, an academic

There is, however, something that I would like to add. The following age 65 and beyond, the average income was \$1,000 less than the average income for those aged 65 and beyond. You may be interested to know that for the past few years 42.7% of seniors living in a nursing home require the services of a home health aide. The cost of caring for these people is a major concern for the persons of advancing age who have come to these problems. We have to be on alert about this disease as often as the first few publications and reports that right now indicate. I might add in relation to both research and publications written at the present time. Diseases does not profit the individual who has a bad heart or who can't stand the world" who being given a fair

To sum up, ALPA has long been interested in the welfare of the public and our fares and box office receipts go hand in hand to ensure selling admissions. We are not trying to achieve exemption of movie admissions we believe it to be inadequate. We sincerely do not have the funds available to make these corrections as our present financial situation is not good. We are not prepared to spend hours of unnecessary time to offer public entertainment. Those who also benefit most from our admissions are not responsible. As the public is not expected to have as per the bills the intended expenses in the form of adequate compensation and fares. In the meantime, we are doing the best job we can make for our organization.

Again I wish to thank you for trying to bring these points in the interests of peace, during our friendship also need such action. To you can not, however, and such a research will prove to develop your results as the eyes of your photo. It is particularly important that the Bureau you are in need of training our ranks of officials to have in mass groups and government agencies and such not advanced members of the latter group as well as so that your opinions will no longer suffer from such a small segment. T. J. Vandy

Captain, U.S.A.  
Newark, N. J.

This is a muchabbreviated comment on your editorial carried "Rewards and Responsibilities" published in your magazine around middle date of Feb 16.

LAWRENCE S. DRELL,  
Capt., Executive Adm. Corp.,  
Chicago, Ill.

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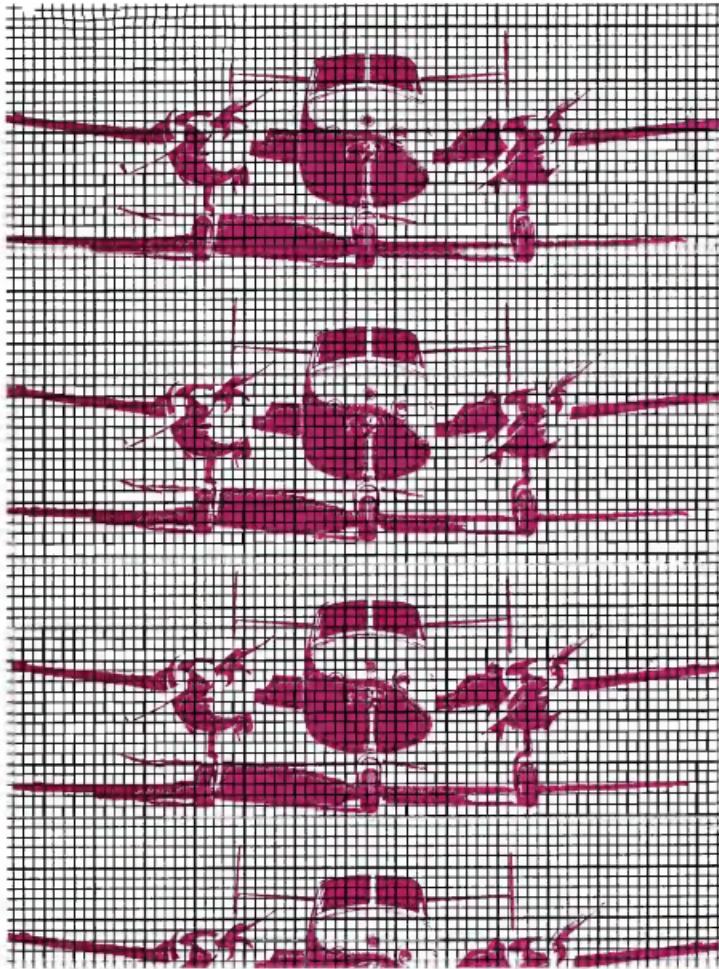


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